

# pygnmi

The Python gNMI client

# What are we going to discuss today?

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- How does network programmability look like today?
- What is the gNMI and where is that used nowadays?
- How can pygnmi help with network automation?

How does network programmability look like today?

```
36 self.logger.info("Request %s", request)
37 if path:
38     self.file = open(os.path.join(path, "requests.txt"), "a")
39     self.file.seek(0)
40     self.fingerprints.update(request)
41
42 @classmethod
43 def from_settings(cls, settings):
44     return cls(job_dir=settings.get("job_dir", "job_dir"))
45
46 def request_seen(self, request):
47     fp = self.request_fingerprint(request)
48     if fp in self.fingerprints:
49         return True
50     self.fingerprints.add(fp)
51     if self.file:
52         self.file.write(fp + os.linesep)
53
```

# How does network programmability look like today?

## Text-driven vs Model-driven automation:

### Text-driven

**What:** manipulation of the configuration files followed by optional restart of the services/daemons

**Where:** (a) Legacy network equipment and (b) Linux and Linux-based operating system

**Why:** (a) Model-driven configuration is not supported (intentionally or not) and (b) desire to eliminate the configuration discrepancies

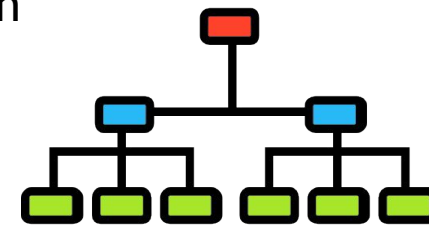


### Model-driven

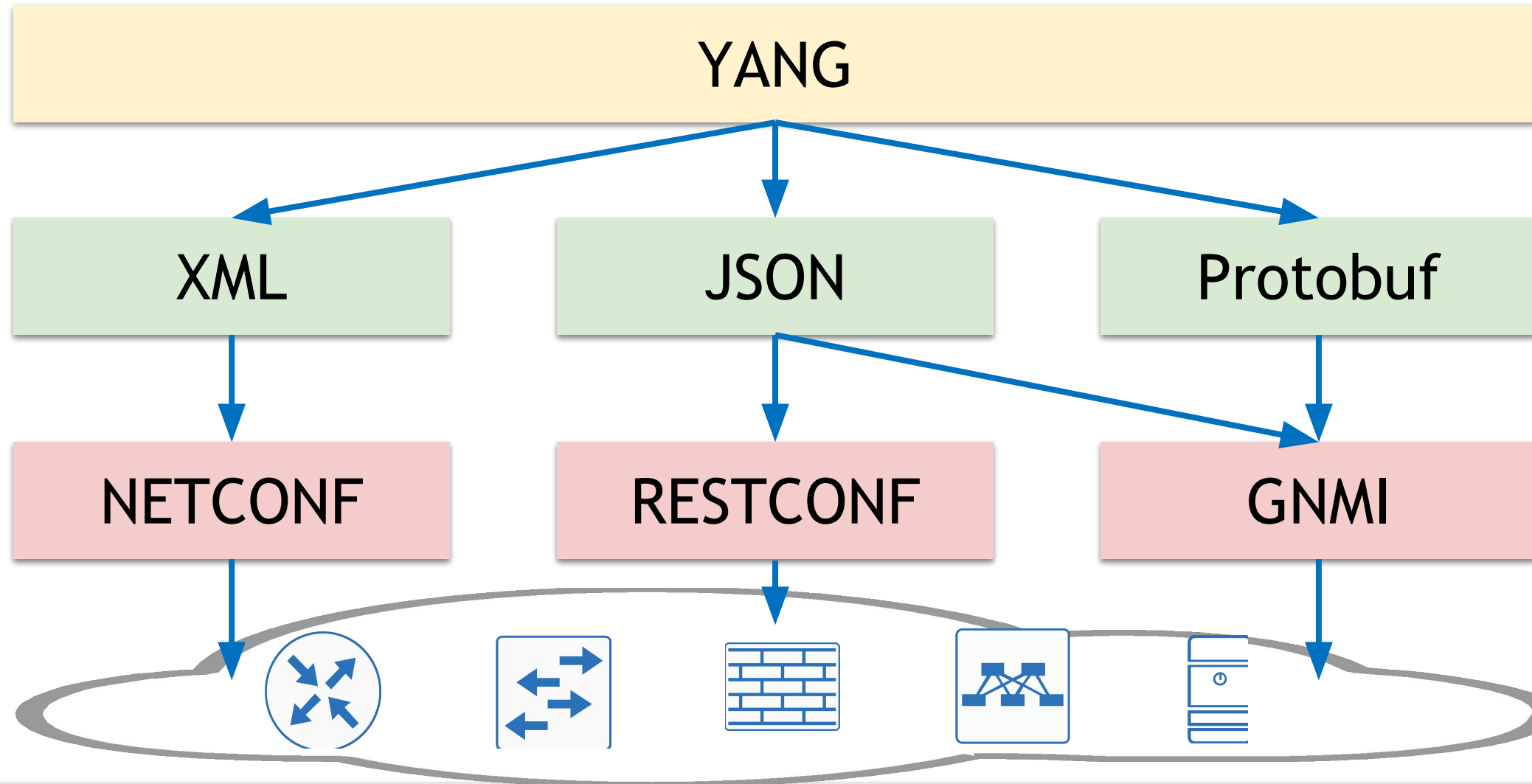
**What:** interaction with the target endpoint as a collection of key-value pairs based on YANG modules or JSDs

**Where:** Modern-ish network operating systems or any application via API (REST, gRPC, etc)

**Why:** (a) Same experience and approach for network and application management and (b) unified information for configuration and data collection



# How does network programmability look like today?



What is the gNMI and where is that used nowadays?

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```

```
self.logger
if path:
    self.file = open(os.path.join(path,
    self.file.seek(0)
    self.fingerprints.update(e.response)

@classmethod
def from_settings(cls, settings):
    return cls(job_dir=settings)

def request_seen(self, request):
    fp = self.request_fingerprint(request)
    if fp in self.fingerprints:
        return True
    self.fingerprints.add(fp)
    if self.file:
        self.file.write(fp + os.linesep)
```

# What is the gNMI and where is that used nowadays?

## What is what: gRPC and gNMI

### gRPC

**What:** unified RPC framework

**What exactly:** defines the interaction with transport protocol, possible ways of communication, message handling, etc

### gNMI

**What:** gRPC-based Specification

**What exactly:** defines names and types of RPCs and format of the messages based on gRPC transport

# What is the gNMI and where is that used nowadays?

## gRPC/gNMI: brief history of time

### Initial scope

- Telemetry



### Current scope

- Telemetry
- Device management (gNMI)
- Device operation (gNOI)





# What is the gNMI and where is that used nowadays?

gNMI operation types (and comparison to NETCONF/RESTCONF):

Operation	gNMI	NETCONF	RESTCONF
Collect information about the YANG modules supported by the endpoint	Capabilities	get-schema	GET to a specific endpoint
Collect the configuration or operational data	Get	get, get-config	GET
Modify the configuration	Set	edit-config, delete-config	POST, PUT, PATCH, DELETE
Collect the operational data on a push-basis	Subscribe	create-subscription, notification	-

How can pygnmi help with network automation?

```
36 self.logger.info('Request: %s', request)
37 if path:
38     self.file = open(os.path.join(path, request), 'a')
39     self.file.seek(0)
40     self.fingerprints.update(request)
41
42 @classmethod
43 def from_settings(cls, settings):
44     return cls(job_dir=settings.get('job_dir', 'job_dir'))
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```

# How can pygnmi help with network automation?

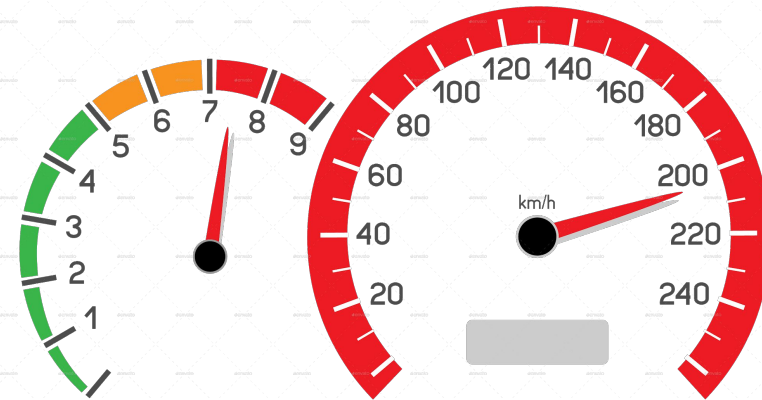
What do we expect from Python library for **network automation**?

Simplicity



Simple usage, automation for networkers

Performance



Speedy operation

# How can pygnmi help with network automation?

What exists in open source world for gNMI?

## Official openconf/gnmi bindings



### Pros:

- All possible features

### Cons:

- Very complex
- Need to understand Protobuf well

<https://github.com/openconfig/gnmi>

## gNMIc



### Pros:

- All possible features

### Cons:

- Not Python
- CLI tool

<https://gnmic.kmr.d.dev>

# How can pygnmi help with network automation?

## What is pygnmi?

### INPUT

Native Python formats

e.g.

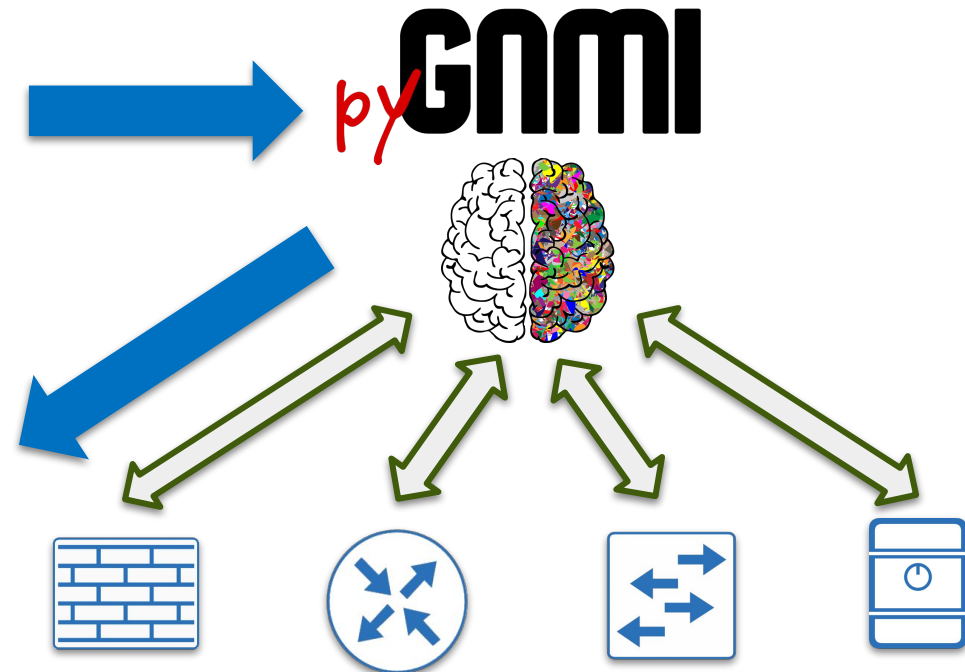
```
[openconfig-interfaces:interfaces/interfaces=[1/1/c1/1]]  
or  
(openconfig-interfaces:interfaces/interfaces=[1/1/c1/1],  
{config: {"name": "1/1/c1/1"}})
```

### OUTPUT

Native Python formats

e.g.

```
{notification:  
  [  
    {timestamp: 0},  
    ...  
  ]  
}
```



<https://github.com/akarneliuk/pygnmi/>

# How can pygnmi help with network automation?

## What does pygnmi support?

### Ready



#### Calls:

- Capabilities
- Get
- Set
- Subscribe (JSON, Protobuf)

#### Channels:

- Insecure
- Secure with certificate

### Plans



#### Channels:

- Secure without certificate (e.g. skip certificate validation)

#### Functionality:

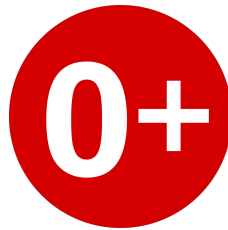
- CLI

<https://github.com/akarneliuk/pygnmi/>

# How can pygnmi help with network automation?

Why is pygnmi that beneficial for you?

Simplicity



Easy to use

Integration with Nornir



Use your favorite automation framework

Python dictionary



No need to convert/parse data

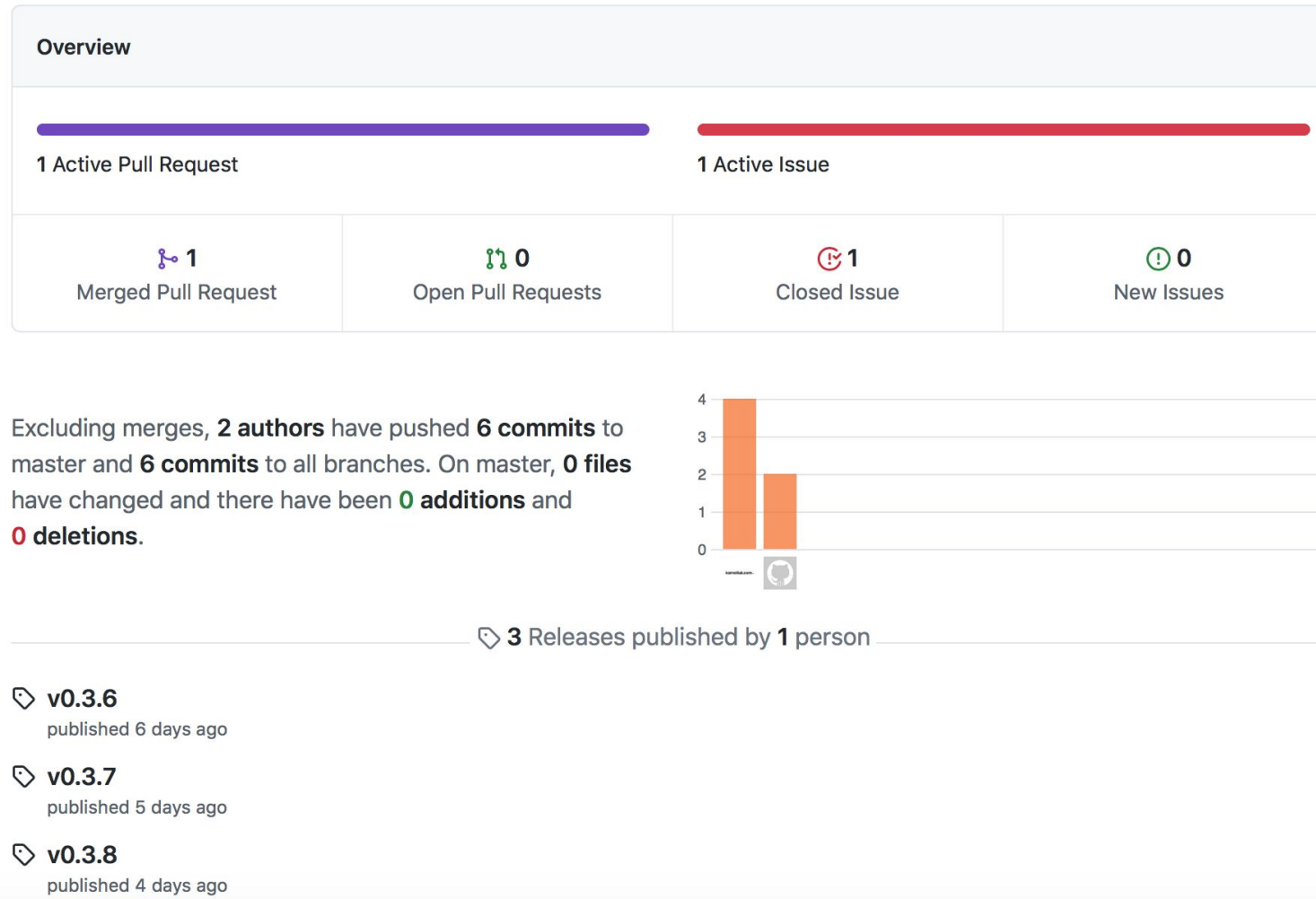
High-quality backend



Relies on the official Google library

# How can pygnmi help with network automation?

1st issue, 1st pull request:





# How can pygnmi help with network automation?

## Installation of pygnmi:



Pygnmi is available at [pypi.org](https://pypi.org) → Just install it using **pip**.  
Prerequisites: Python 3.7 - 3.9

```
# Install pygnmi library
$ pip install pygnmi

# Check pygnmi version
$ python3.7 -c 'import pygnmi; print(pygnmi.__version__)'
0.3.8
```

<https://pypi.org/project/pygnmi/>

# How can pygnmi help with network automation?

## gNMI Capabilities RPC with pygnmi:

### Code example

```
#!/usr/bin/env python

# Modules
from pygnmi.client import gNMIclient

# Variables
host = ('fd17:625c:f037:2::100', 6030)

# Body
if __name__ == '__main__':
    with gNMIclient(target=host, username='aaa', password='aaa', insecure=True) as gc:
        response = gc.capabilities()

    print(response)
```

# How can pygnmi help with network automation?

## gNMI Get RPC with pygnmi:

### Code example

```
#!/usr/bin/env python

# Modules
from pygnmi.client import gNMIclient

# Variables
host = ('fd17:625c:f037:2::100', 6030)

path =
['openconfig-network-instance:network-instances/network-instance[name=default]/interfaces/interface
[name=Ethernet1]', 'openconfig-interfaces:interfaces/interface[name=Ethernet1]']
datatype = 'all'

# Body
if __name__ == '__main__':
    with gNMIclient(target=host, username='aaa', password='aaa', insecure=True) as gc:
        response = gc.get(path=path, datatype=datatype)

    print(response)
```

# How can pygnmi help with network automation?

## gNMI Set RPC with pygnmi(1):

### Code example

```
## Update call
update_message = []
vv1 = 'openconfig-interfaces:interfaces/interface[name=Loopback10] '
vv2 = {
    "name": "Loopback10",
    "config": {
        "name": "Loopback10",
        "enabled": True,
        "type": "iana-if-type:softwareLoopback",
        "description": "pygnmi-lo-10"
    }
}

update_message.append((vv1, vv2))

## Delete call
delete_paths =
['openconfig-network-instance:network-instances/network-instance[name=default]/interfaces/interface
[name=Loopback30]', 'openconfig-interfaces:interfaces/interface[name=Loopback30]']
```

# How can pygnmi help with network automation?

## gNMI Set RPC with pygnmi(2):

### Code example

```
#!/usr/bin/env python

# Modules
from pygnmi.client import gNMIclient

# Variables
host = ('fd17:625c:f037:2::100', 6030)

# Body
if __name__ == '__main__':
    with gNMIclient(target=host, username='aaa', password='aaa', insecure=True) as gc:
        response = gc.set(update=update_message, replace=None, delete=delete_paths)

    print(response)
```

# How can pygnmi help with network automation?

## gNMI Subscribe RPC with pygnmi (1):

### Code example

```
## Subscription request
subscribe = {
    'subscription': [
        {
            'path': 'openconfig-interfaces:interfaces/interface[name=Ethernet1]',
            'mode': 'sample',
            'sample_interval': 10000000000,
            'heartbeat_interval': 30000000000
        },
        {
            'path': 'openconfig-interfaces:interfaces/interface[name=Management1]',
            'mode': 'sample',
            'sample_interval': 10000000000,
            'heartbeat_interval': 30000000000
        }
    ],
    'use_aliases': False,
    'mode': 'stream',
    'encoding': 'proto'
}
```

# How can pygnmi help with network automation?

## gNMI Subscribe RPC with pygnmi (2):

### Code example

```
#!/usr/bin/env python

# Modules
from pygnmi.client import gNMIclient, telemetryParser

# Variables
host = ('fd17:625c:f037:2::100', 6030)

# Body
if __name__ == '__main__':
    with gNMIclient(target=host, username='aaa', password='aaa', insecure=True) as gc:
        response = gc.subscribe(subscribe=subscribe)

        for telemetry_entry in response:
            print(telemetryParser(telemetry_entry))
```

# How can pygnmi help with network automation?

Join us to learn much more about network automaton:

Unlock your potential with  
**Network Automation Training**

**START => Every 2 months**

<https://training.karneliuk.com>



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```

self.logger  
if path:  
self.file = open(os.path.join(path, 'karneliuk.com'), 'a')  
self.file.seek(0)  
self.fingerprints.update({request.ip})

# Thank you very much for your attention!

@classmethod  
def request\_seen(self, request):  
fp = self.request\_fingerprint(request)  
if fp in self.fingerprints:  
return True  
self.fingerprints.add(fp)  
if self.file:  
self.file.write(fp + '\n')

def request\_fingerprint(self, request):

You can reach us on:

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# About karneliuk.com

## Training services

### Regular trainings:

- Network automation live online
- Network automation self-paced

### Corporate trainings:

- Network automation tailored to company network vendors (e.g. Nokia, Arista, Cisco, Cumulus, etc)

### Individual sessions:

- Ad-hoc consultancy for a specific technologies

## Consulting services

### Network automation:

- Advisory on automation tools
- Development of automation tools and integration in your network

### Network technologies:

- Audit and analysis of your network
- Design and testing (Nokia, Arista, Cisco, Cumulus) for service providers and data centres
- Documentation (design, configuration, slide decks)
- Integration and optimisation

## Our happy customers

**NOKIA** CityFibre



Viasat



Fiber Internet Center  
BUILDING PROACTIVE MANAGED FIBER  
NETWORKS SINCE 2001

Bloomberg

## Our expertise



```
36 self.logger.info('Request seen: %s', request)
37 if path:
38     self.file = open(os.path.join(path, 'requests.com'), 'a')
39     self.file.seek(0)
40     self.fingerprints.update({request})
```

```
41
42 @classmethod
43 def from_settings(cls, settings):
44     debug = settings.getbool('debug')
45     return cls(job_dir(settings), debug)
46
47 def request_seen(self, request):
48     fp = self.request_fingerprint(request)
49     if fp in self.fingerprints:
50         return True
51     self.fingerprints.add(fp)
52     if self.file:
53         self.file.write(fp + os.linesep)
54
55 def request_fingerprint(self, request):
```

# BACK UP

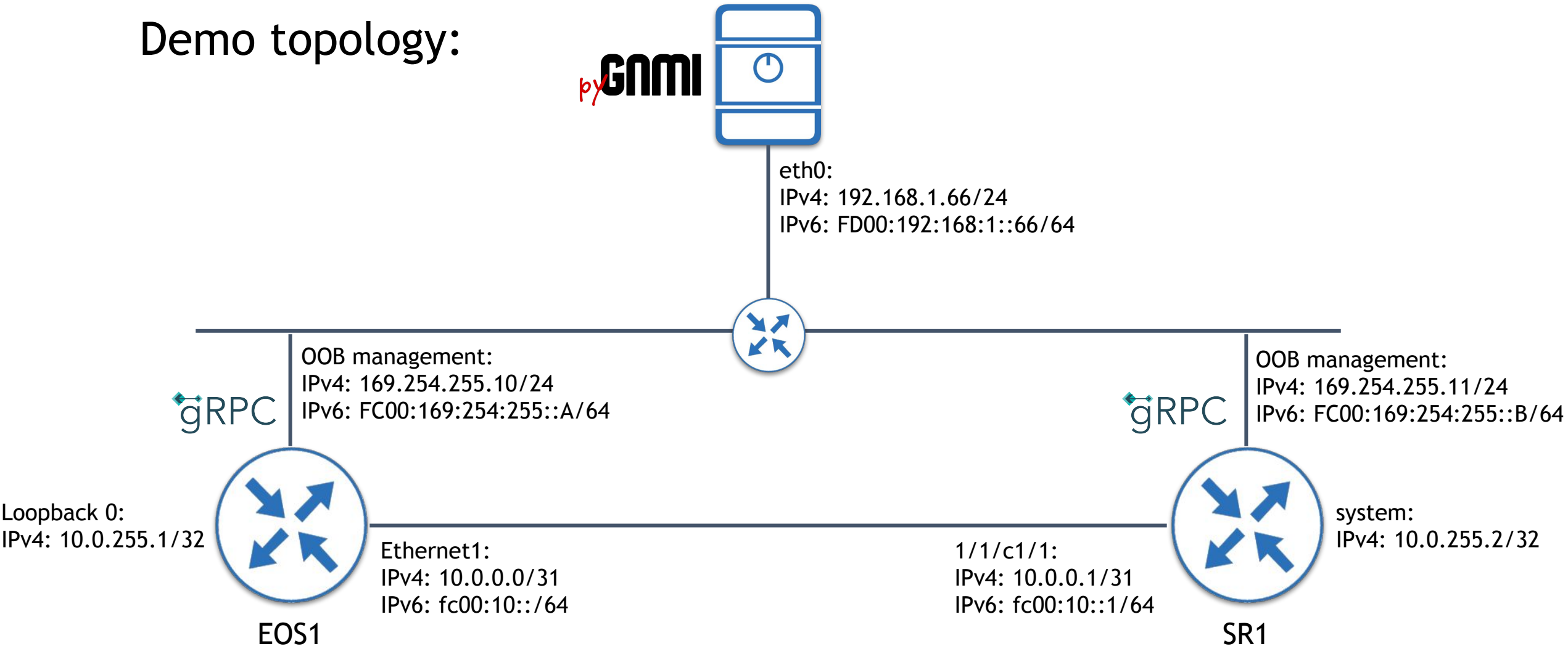
# How can pygnmi help with network automation?

## Useful links:

- GitHub: <https://github.com/akarneliuk/pygnmi>
- PyPI: <https://pypi.org/project/pygnmi/>
- Video tutorial:  
[https://www.youtube.com/watch?v=NooE\\_uHlgys&list=PLsTgo2tBPnTwmeP9zsd8B\\_tZR-kbguvla](https://www.youtube.com/watch?v=NooE_uHlgys&list=PLsTgo2tBPnTwmeP9zsd8B_tZR-kbguvla)
- Blog: <https://karneliuk.com>

# How can pygnmi help with network automation?

Demo topology:



# How can pygnmi help with network automation?

**[LIVE DEMO]** Using pygnmi to manage Nokia/Arista network



Time to get hands dirty!