ORWELL

Monitorization Platform for a 5G Testbed

Research Group

IT - ATNoG

5GASP Project

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Context

_ Testbeds of applications involving 5G infrastructure and networks need tools for monitorization.

_ NetApps deployed in the testbed need monitoring too, done at the VNF/CNF level.

_ Metrics of each VNF/CNF can be obtained through different tools, each with its own collection and storage process.

_ Current testbed monitoring tools are typically intrusive, limited and do not homogenize the data of the whole infrastructure.

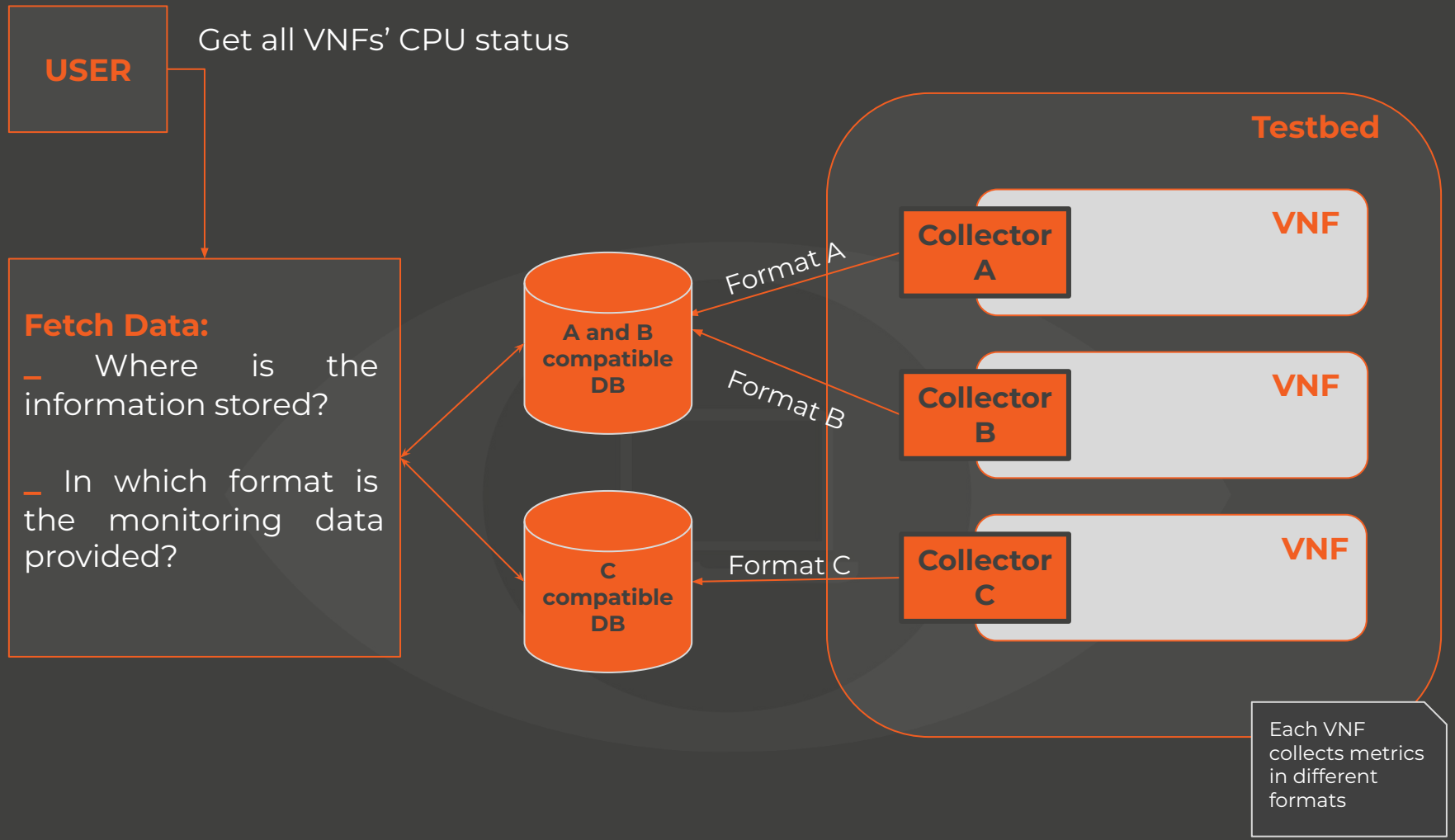
Context - Intrusive vs Non-Intrusive

_ **Intrusive** means that the monitoring tool needs to log into the VNF, i.e. have access to it in order to run the metrics collection mechanisms.

_ **Non-intrusive** monitoring tools do not need access to the VNF.

_ Ideally, we want non-intrusive tools, so NetApp owners don't need to give us access credentials, raise conflicts at application level or require any software installation.

Problems


USER
Get all VNFs' CPU status
Fetch Data:
_ Where is the information stored?
_ In which format is the monitoring data provided?
A and B compatible DB
C compatible DB
Format A
Format B
Format C
Testbed
Collector A
Collector B
Collector C
VNF
VNF
VNF
Each VNF collects metrics in different formats

Problem

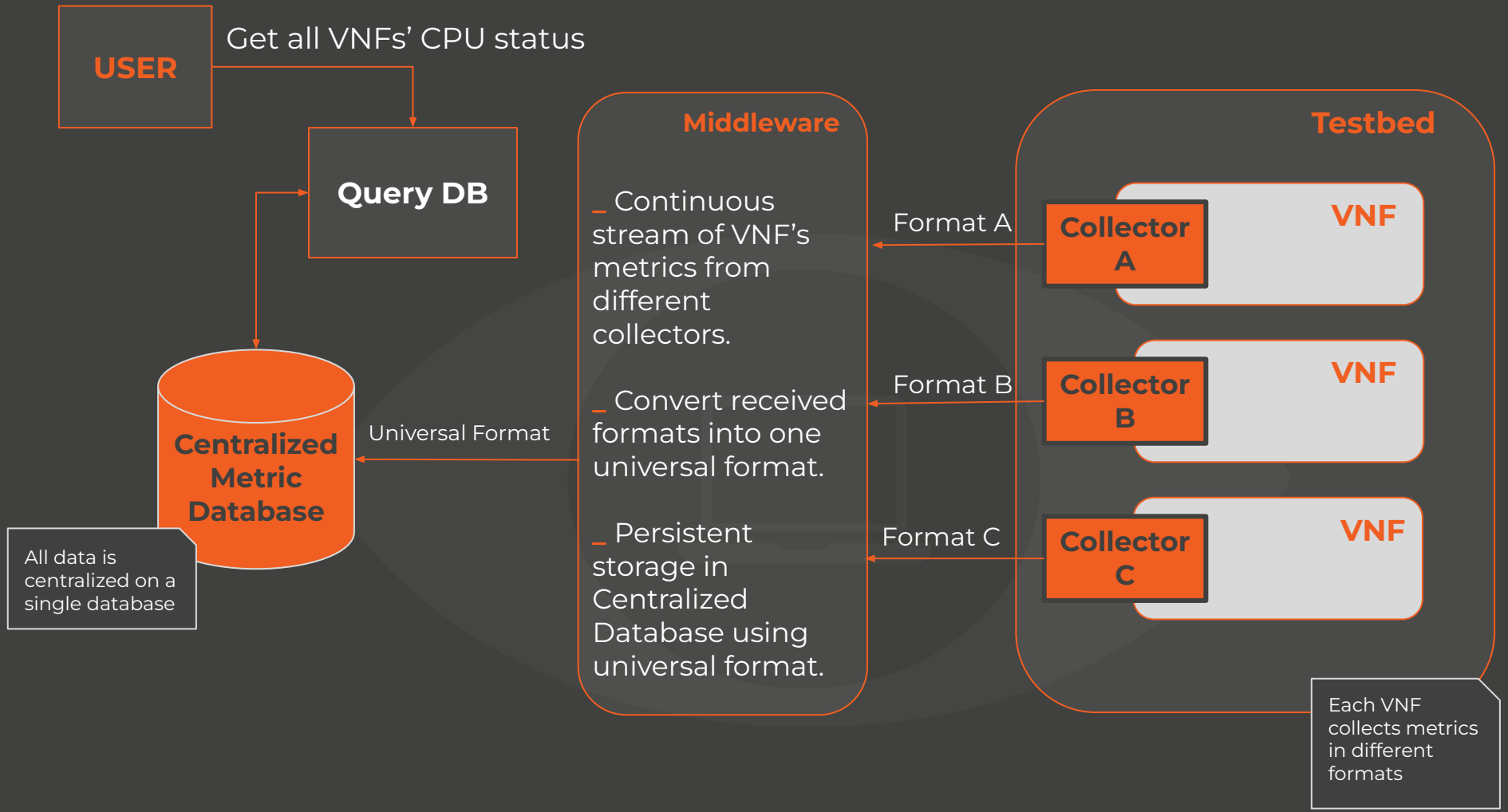
_ Monitor network and netapps in the 5G testbed giving the possibility of non-intrusive metrics collection.

_ Analyse metrics, create logs and reports and setup alarms.

_ Each VNF has its own way of collecting metric's related data (non uniform data access interface).

_ Provide network safety mechanisms for testbeds.

Goals


USER
Get all VNFs' CPU status
Query DB
Centralized Metric Database
All data is centralized on a single database
Universal Format
Middleware
_ Continuous stream of VNF's metrics from different collectors.
_ Convert received formats into one universal format.
_ Persistent storage in Centralized Database using universal format.
Format A
Format B
Format C
Testbed
Collector A
Collector B
Collector C
VNF
VNF
VNF
Each VNF collects metrics in different formats

Goals

_ Support intrusive and non-intrusive metrics collecting, provided by a wide range of exporters.

_ Centralize the exported data in Prometheus, integrated with a Grafana instance for data visualization - a 5GASP standard.

_ Integrate cybersecurity tools to detect possible malicious activities

_ Guarantee availability and performance of the system given its high data volume

Calendar and Tasks

29/3

- Explore Useful Tools
  Prometheus, Grafana, Netdata, Telegraf, perfSONAR, ntop, SNMP, ...
- Design Architecture

05/4

- Choose Implementation Technologies
- Initialize Development Environment
- Create Service Discovery API
- Explore Testbed/Network-level Metrics
- Explore 5G Core-level Metrics

12/4

- Create OS Cloud Images With Monitoring Tools
- Intrusive Tools via Cloud-init
- Intrusive Tools via Juju Charms
- Explore Message Queues For Message Aggregation

19/4

- Middleware Demo
  Monitor 1 Prometheus instance via Push
- Decouple Middleware's Data Source For Intrusive Tools
- Implement Message Queues
- Support Push and Pull Approaches

26/4

- Explore Non-Intrusive APIs
- Explore Network APIs

03/5

- Accept Network And Non-Intrusive Data in Middleware
- Explore Security Mechanisms

Calendar and Tasks

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_ Implement Security Mechanisms

_ Implement Data Exporting

_ Create Development Environment For Frontends

17/5

_ Create Frontends

_ Create Requirements For Reports

24/5

_ Explore Alarms' Requirements

_ Explore Authorization Mechanisms For Grafana

_ Expore Middleware Minification

31/5

_ Create Technical Report

_ Implement Authorization In Grafana

_ Implement Alarms' Plugin

14/6

_ Rework Technical Report

_ Prepare students@deti Material

21/06

_ Prepare Final Presentation

Communication

GitHub Repository

Slack Channel

ClickUp

To keep up with our work visit our website: orwellmonitoring.github.io

Expected Results

- End-to-end monitoring platform
- Support different metrics and collectors
- Possibility of adding new tools with ease
- Assure testbed’s security
- Guarantee the alarmistic of problematic situations

Related Work

_ A. Wolke and D. Srivastav, "Monitoring and Controlling Research Experiments in Cloud Testbeds," 2013 IEEE Sixth International Conference on Cloud Computing, 2013, pp. 962-963, doi: 10.1109/CLOUD.2013.97.

_ E. Magana, A. Astorga, J. Serrat and R. Valle, "Monitoring of a virtual infrastructure testbed," 2009 IEEE Latin-American Conference on Communications, 2009, pp. 1-6, doi: 10.1109/LATINCOM.2009.5305030.

_ M. Shirali, M. Sharafi, M. Ghassemian and F. Fotouhi-Ghazvini, "A Testbed Evaluation for a Privacy-Aware Monitoring System in Smart Home," 2018 IEEE Global Humanitarian Technology Conference (GHTC), 2018, pp. 1-7, doi: 10.1109/GHTC.2018.8601929.

_ Divneet Kaur, Bashir Mohammed and Mariam Kiran, “NetGraf: A Collaborative Network Monitoring Stack for Network Experimental Testbeds” arXiv:2105.10326v1 [cs.DC] 18 Mar 2021

State of The Art - Collectors

Tool	Characteristics	Push/ Pull	Communication channel	Integration with Prometheus
Prometheus	Own time series database. Exporter to allow metric's pushing. Easy integration with Grafana.	Both	HTTP	✔
Telegraf	Runs on the stack side. Easy connection with Kafka.	Push	TCP	✔
Zabbix	Server related statistics. OpenStack monitoring.	Pull	HTTP	✔ third-party exporter

State of The Art - Collectors

Tool	Characteristics	Push/ Pull	Communication channel	Integration with Prometheus
ntopng	Network statistics collector. Supports the most used web protocols. RestAPI for easy integration.	Both	TCP, UDP	✔ third-party exporter
Netdata	Open-source metrics collection mechanism. ML irregular situation detection. Low resource usage.	Pull	HTTP	✔
perfSONAR	Network measurement toolkit.	Push	HTTP	✔ out of the box in version 4.3

Thank You

We will be watching you