



**GHENT
UNIVERSITY**

SOFTWARE DEVELOPMENT & OPERATIONS

Prof. Dr. Bruno Volckaert – bruno.volckaert@ugent.be

LECTURER

- Prof. Dr. Bruno Volckaert (bruno.volckaert@ugent.be)
- IDLab
 - <https://www.ugent.be/ea/idlab/en>
 - <http://idlab.technology/>
- Department of Information Technology (INTEC)
- Ghent University – IMEC
- E-mail DevOps: devops@lists.ugent.be
- Teaching
 - 2nd bach
 - System programming
 - 3rd bach
 - Software development & operations
 - Distributed Data Processing
 - Summer of Code
 - Master
 - System administration
 - Cloud storage & computing (Major data engineering)
 - Network security (Major cybersecurity)



COURSE SPECIFICATIONS

- Course size: 3 credits
- Study time: 90h
- Contact hours: 30h
 - Lectures: 12h
 - Seminars: 18h
- Written examination
- Final grade calculation
 - 50% on exam
 - 50% on end-result labs (project)
- Individual scores (exam / project) minimally 9/20
 - Otherwise score maximum 9/20
- Important: labs cannot be done from scratch in 2nd term due to evolution Kubernetes cluster
- Note: PPT slides require the UGent Panno font to be shown correctly
 - Explanation on install: <https://styleguide.ugent.be/basisprincipes/typografie.html>

COURSE SPECIFICATIONS

- Learning material
 - Slides on Ufora
- Initial competences
 - Object oriented programming (C#, Java) , software development
 - Basic knowledge of web technologies and data formats (HTTP, JSON, YAML)
 - Basic knowledge of Linux
- Final competences
 1. Students can extract software requirements for a problem
 2. Students can choose an appropriate software development model for a new software project
 3. Students can collaborate on a software project through Git
 4. Students can set up a CI/CD pipeline for a software project
 5. Students know how software can be managed in production

SCHEDULE

Schema DevOps 2024-2025			
	day / hours	date	content
week 1	do 9:30-12:30	26-Sep	Theorie 1
week 2	do 9:30-12:30	03-Oct	Theorie 2
week 3	do 9:30-12:30	10-Oct	Lab 1
week 4	do 9:30-12:30	17-Oct	Theorie 3
week 5	do 9:30-12:30	24-Oct	Lab 2
week 6	do 9:30-12:30	31-Oct	vrijaf
week 7	do 9:30-12:30	07-Nov	Theorie 4
week 8	do 9:30-12:30	14-Nov	Lab 3
week 9	do 9:30-12:30	21-Nov	Theorie 5
week 10	do 9:30-12:30	28-Nov	Theorie 6
week 11	do 9:30-12:30	05-Dec	Lab 4
week 12	do 9:30-12:30	12-Dec	Lab 5

QUESTIONS / REMARKS

- During lectures and labs
 - Check Ufora for updates on planning of labs and lectures
- Ufora
 - Announcements
 - Lab solutions via Git
 - Feedback
- General e-mail list: devops@lists.ugent.be
 - Mailing list is not public

LAB RESPONSIBLES



ir. Thomas Dupont



ir. Wannes Kerckhove



ing. Jasper Vaneessen

SOFTWARE = COMPLEX



15 min
BEFORE RAIN
APPROACHES YOU

✈️ 05 min 37 sec
BEFORE ARRIVAL

✈️ 08 min 07 sec
SINCE DEPARTURE

🌞 1,214 KWH
GAINED

☀️ ☀️ ☀️
1,358 KWH
GAINED

✖️ 04 TABLES LEFT

✖️ FULLY BOOKED

23 WATT
USED



ENERGY SAVING
MEDAL UNLOCKED



🕒 17 HOURS
PARKING LEFT

🛢️ 432 METER TO THE
CHEAPEST DIESEL

🚦 04 RED LIGHTS
ON YOUR WAY

YOU WALKED 1894 METER
SO FAR

🚚 YOUR PACKAGE
WILL ARRIVE IN 15 MIN

🚲 235 METER UNTIL
BIKE PARKING

🍔 124 PEOPLE
FAVORISED



Air quality

Microservices work on data

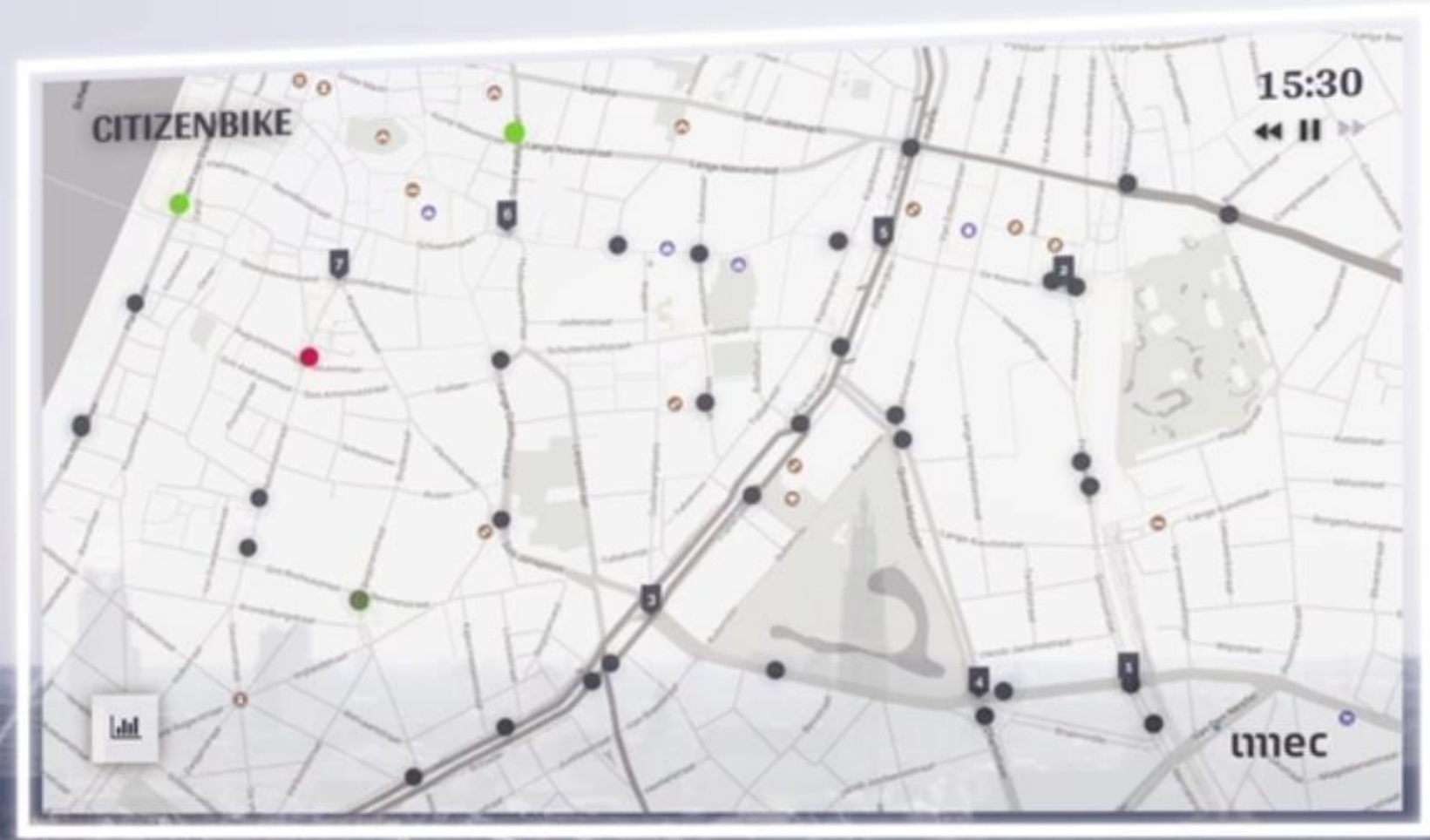
- Area
- Metric
- Precision

Calculate statistics

- Per hour
- For each geohash
- Different granularities

Specialized datastores



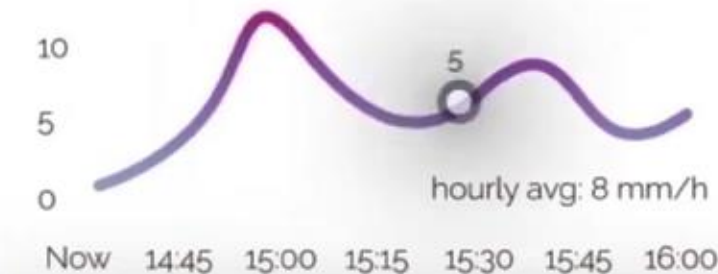


Legend (mm/h)

- 100+
- 10-100
- 5-10
- 2-5
- 0-2

OK CRITICAL

Expected rainfall Antwerpen



Intervention 1: 1172420010

Priority 2

Status TP

Date: 05/09/2017 - 09:51:11

Location:

2000 Antwerpen (Antwerpen)
Oudaan 5

Description:

Interventiecode: 50300123 (wateroverlast)
Parking politiekantoor

Name of caller: Thijs G. (Secretariaat Politie)

Type of intervention: Brandweer

Team: AP_1HA_PZ

Status: Vertrekt naar plaats / Uitgerukt

Location: Terninckstraat, 2000 Antwerpen



FLANDERS MAKE COLLABORATION

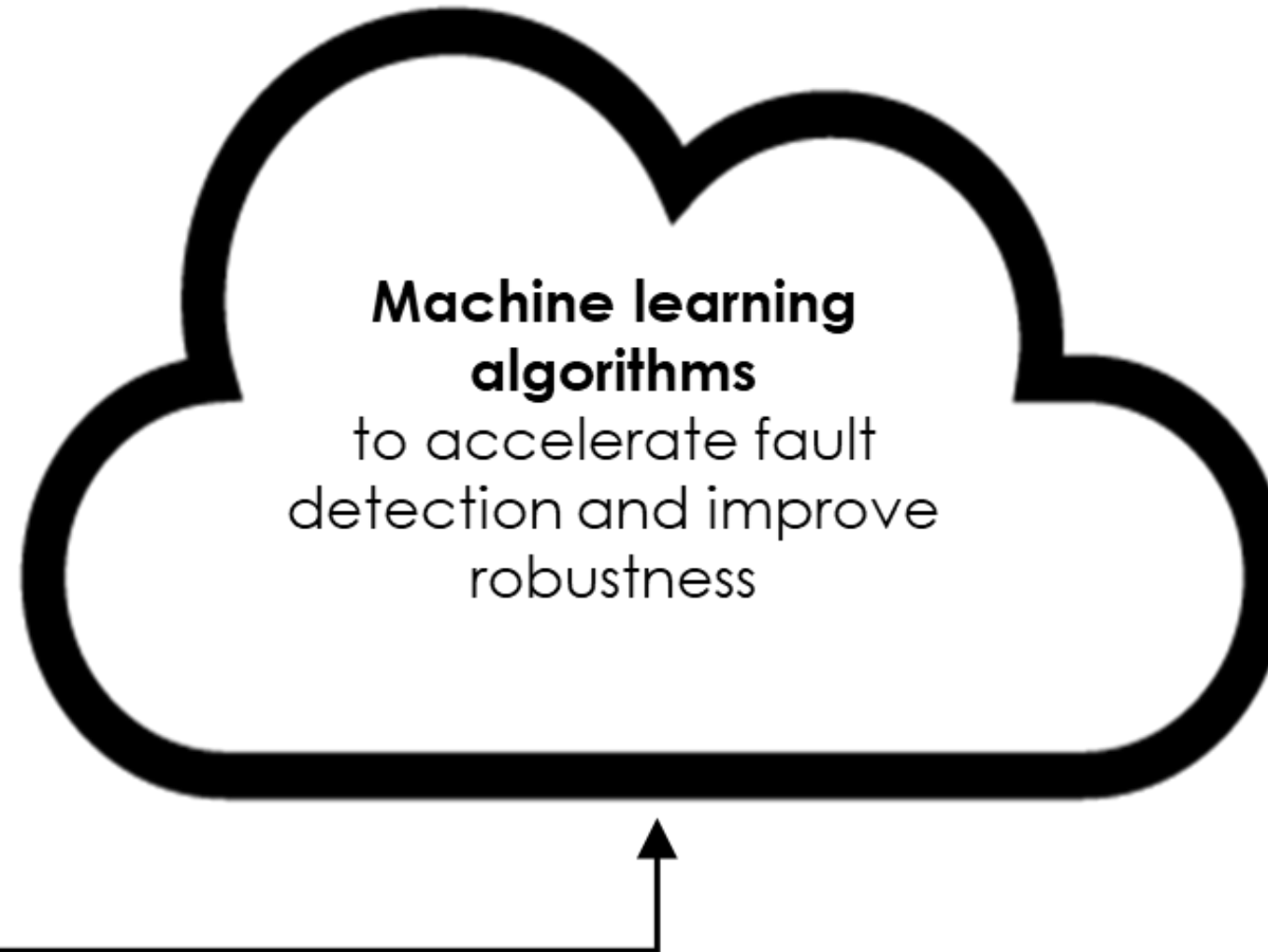
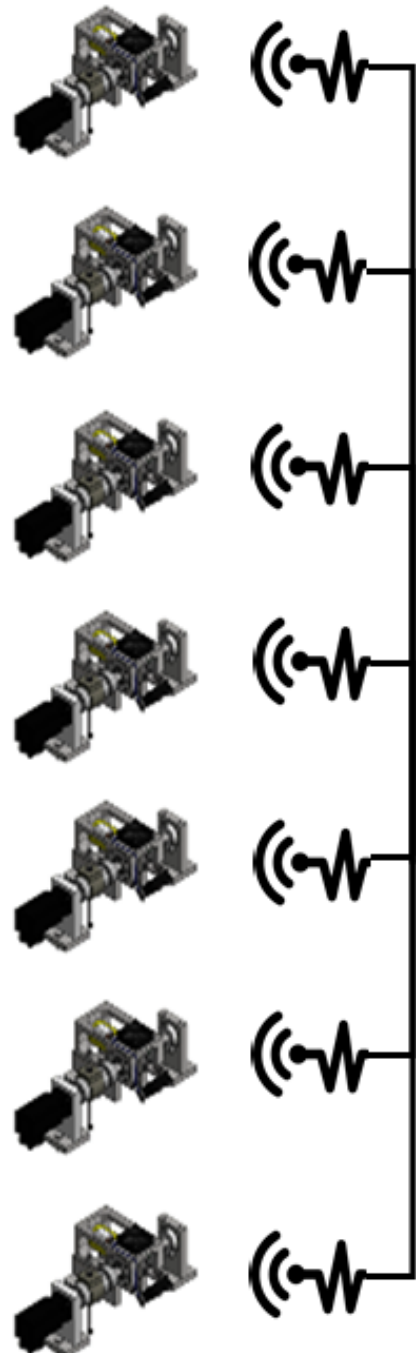
Fleet monitoring of machines
with degrading bearings

Cloud data ingestion, storage and offering
Open, flexible and elastic

Dynamic dashboard
for decision support at
any location

**Low-cost
monitoring
hardware**

**Local data
reduction**
by smart
algorithms



[OBELISK - HTTPS://GITHUB.COM/IDLAB-DISCOVER/OBELISK](https://github.com/idlab-discover/obelisk)



Who?

Smart City, IoT, science experiments, ...

What? Time series!

Sensors/events/... (°C, dB, lm, ...)

Location-based (lat/lon/z, geohash)

Timestamped (high precision)

Who?

Citizens, apps, backends, ...

Goals?

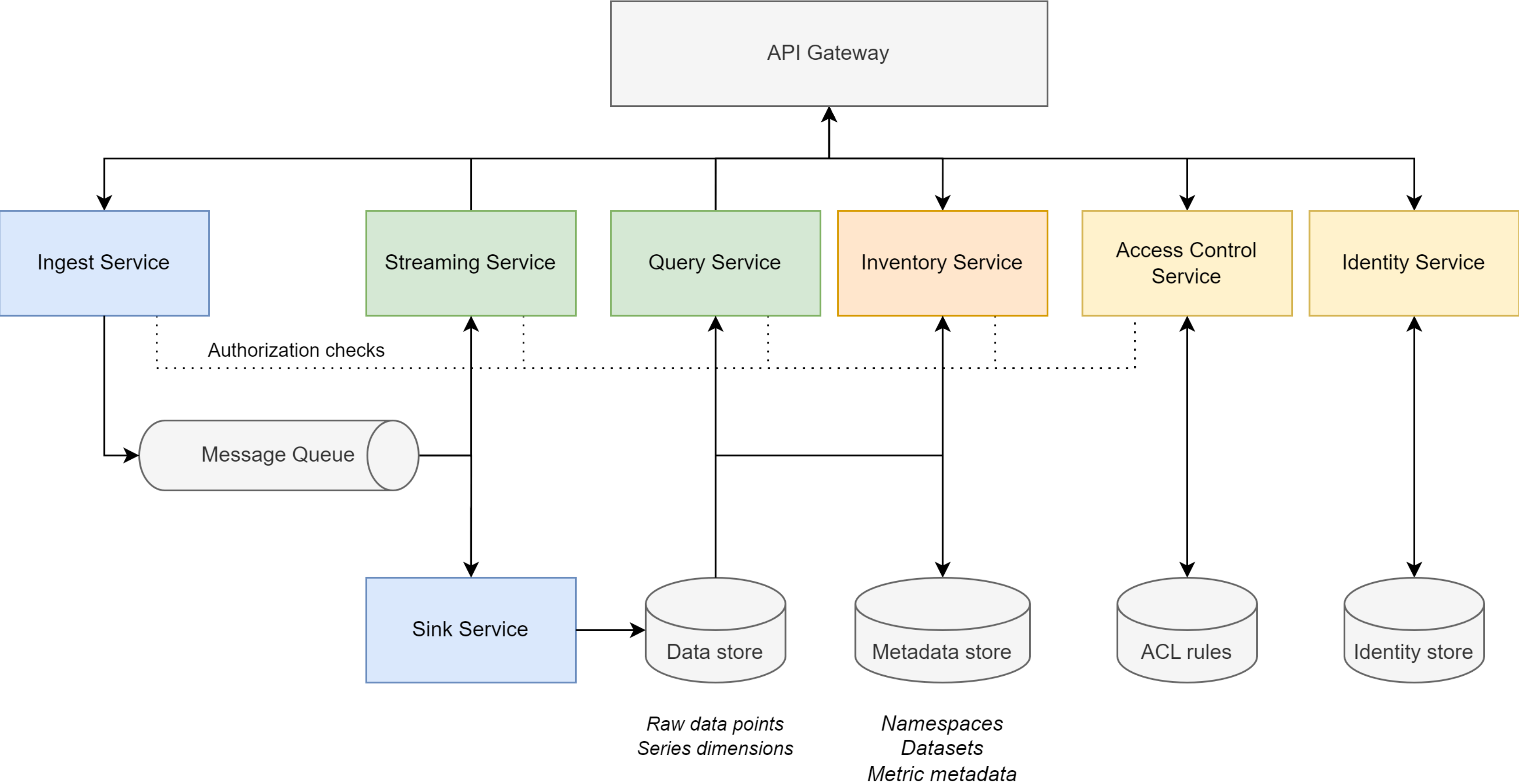
Public web pages

Analysis tools

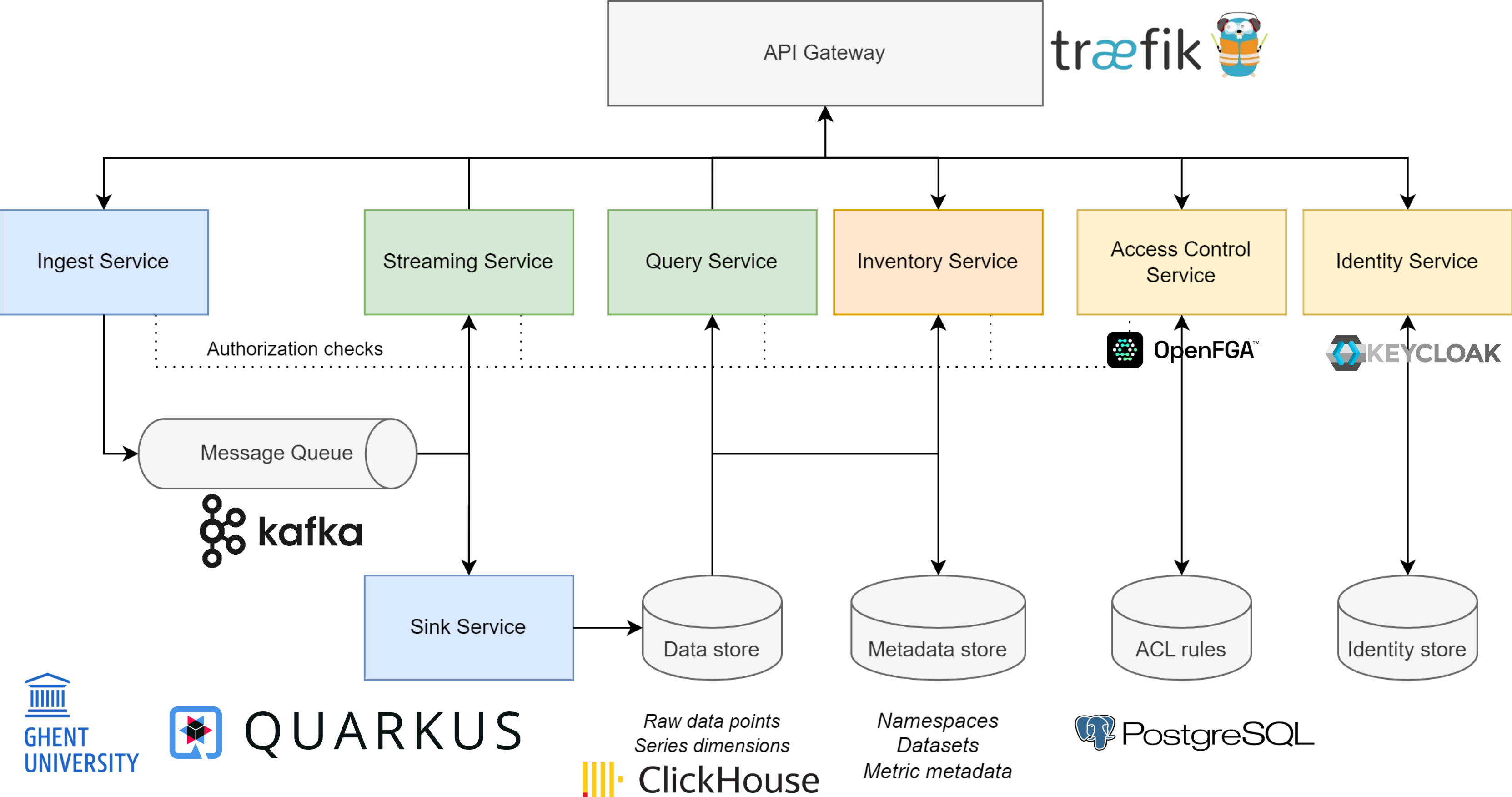
Post-processors

Governance support

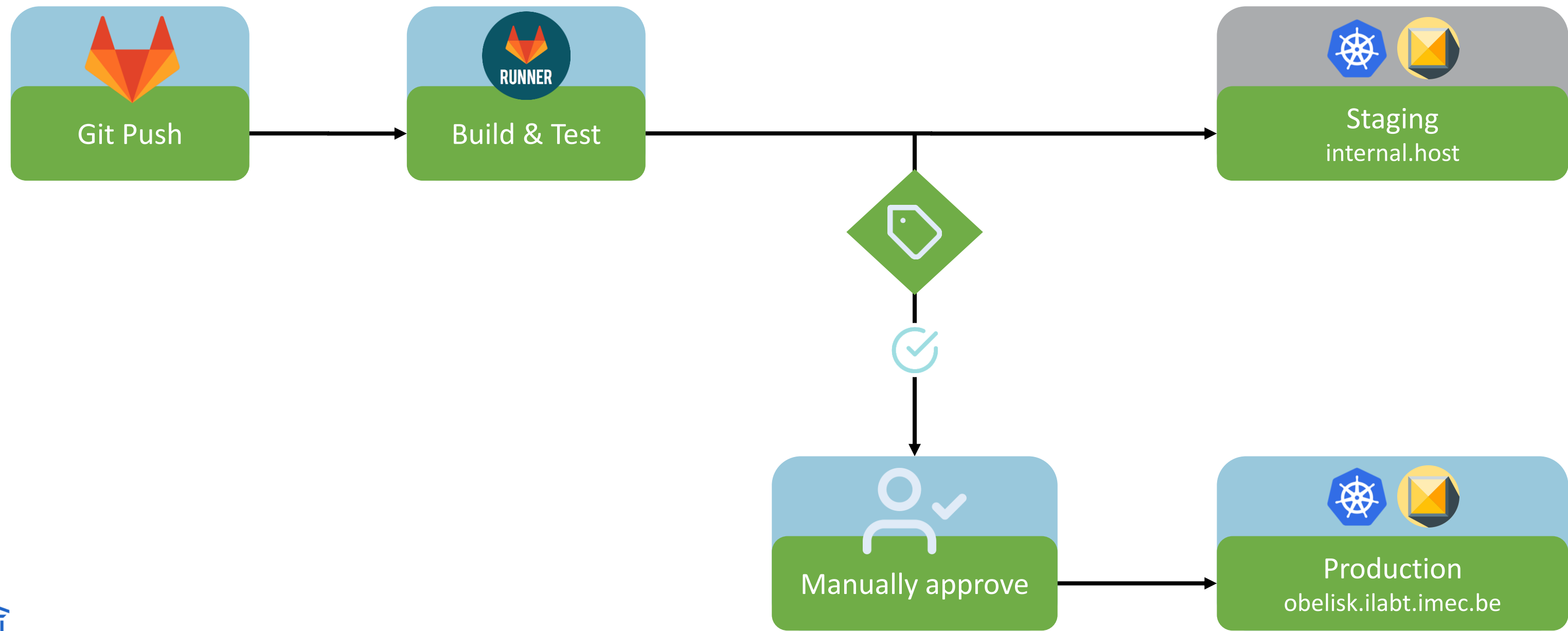
OBELISK ARCHITECTURE



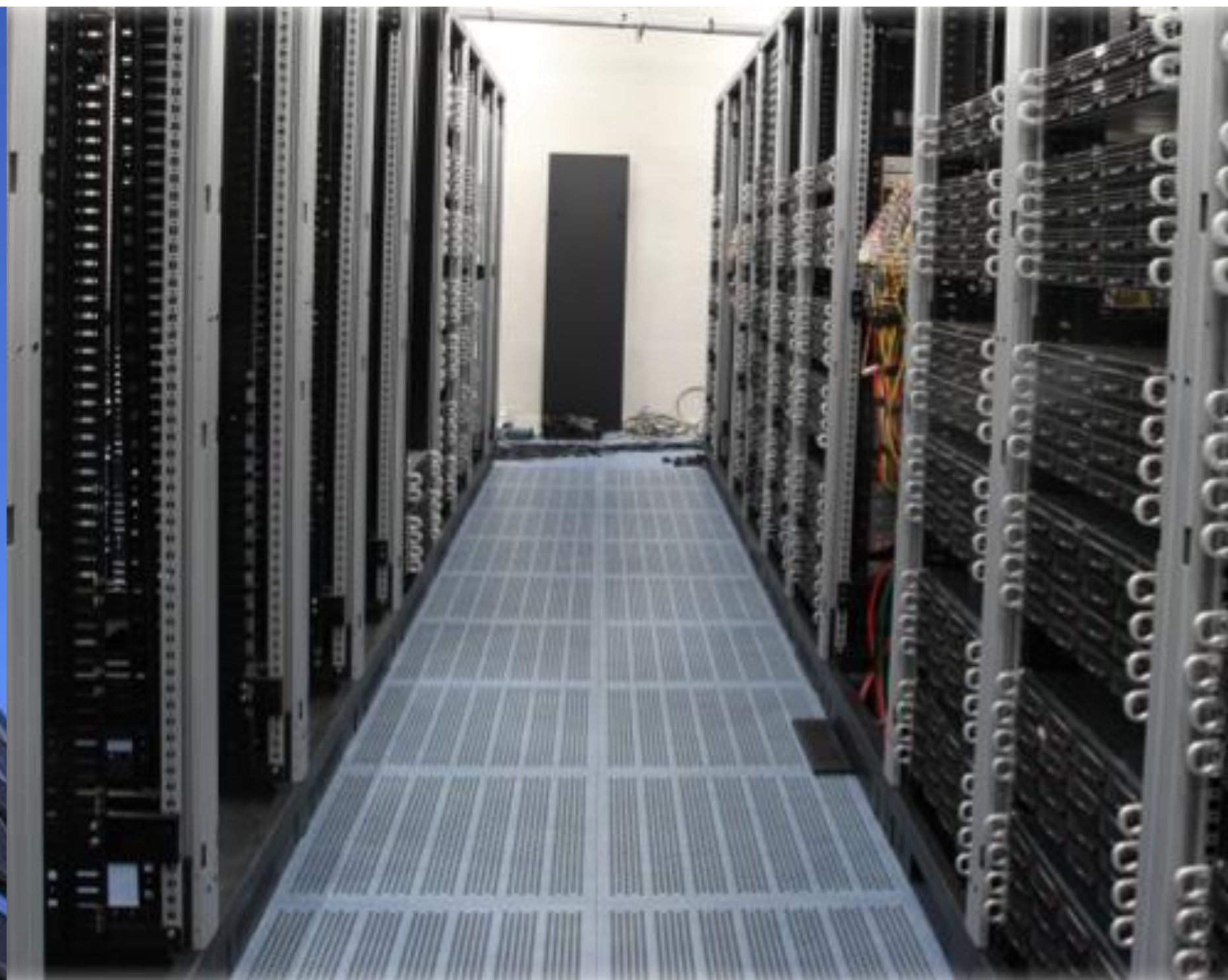
OBELISK TECHNOLOGIES



CI/CD PIPELINES

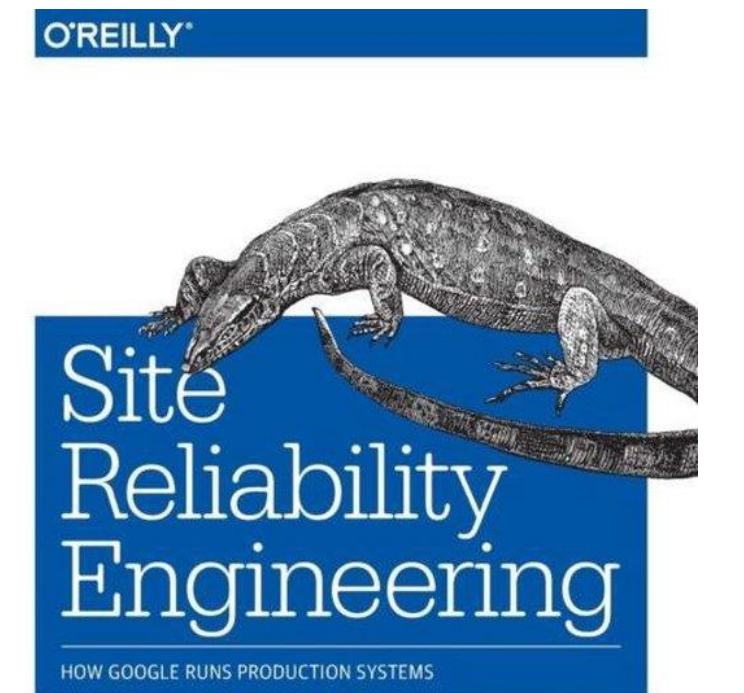
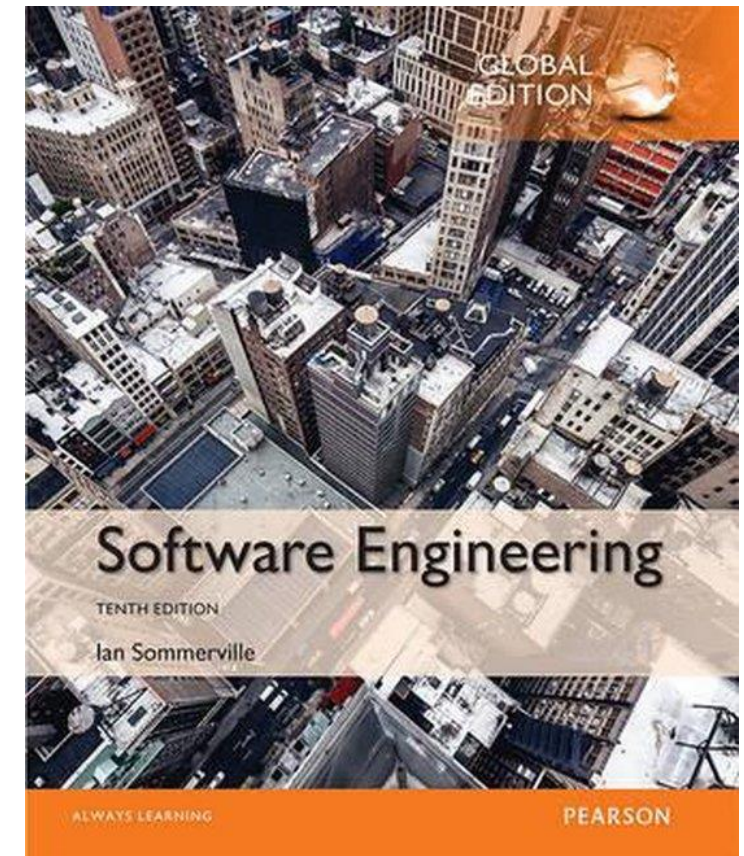


SO WHERE IS ALL THIS DEPLOYED?



REFERENCES

- This course extracts, combines and evolved information from a range of courses and books
 - Course “Software Engineering” – Industrial Engineer Electronics-ICT - Bruno Volckaert
 - Industrial course “Microservices & containers” – Bruno Volckaert
 - Software Engineering – 10th edition – Ian Sommerville – Pearson
 - Site reliability Engineering – Betsy Beyer, Chris Jones - O'Reilly
 - Various tutorials of product websites: Docker, Kubernetes, etc.



Edited by Betsy Beyer, Chris Jones,
Jennifer Petoff & Niall Richard Murphy