Raspberry Pi: Filter Station

- Runs on: OpenSuse and OpenJDK 8
- Capable of the following:
  - Receiving measurements
  - Correcting the measurements
    - Keep 30 last measurements for each station ID
    - Exponential Weighted Moving Average:
      - Most recent data weights most
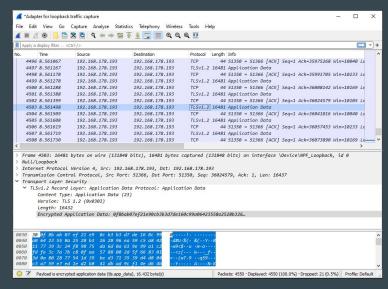- Send corrected data every 10 seconds

Data from Pi to Database Server

- Client-Server
- TLS(v1.2)
- Encrypted (TLS_RSA_WITH_AES_128_CBC_SHA)
- Multiple connection possible
- Automated
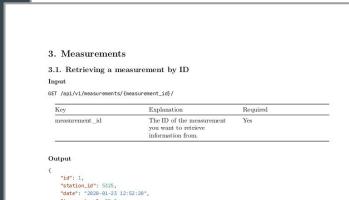
{"port":445,"response":"LISTENING","ipAddress":"40.114.144.127"}

Database Server & API

- H2-Database (in-memory-database with hibernation)
  - Capable of handling at least 8000 new measurements per second
- RESTful-api for web requests
- http-basic-authentication for users
- Connection between raspberry-pi and VPS is completely automated
- All queries have been fully documented
- Build and runs in a Docker-container
  - Using multi-stage building

H2

3. Measurements

3.1. Retrieving a measurement by ID

Input

GET /api/v1/measurements/{measurement_id}/

Key	Explanation	Required
measurement_id	The ID of the measurement you want to retrieve information from.	Yes

Output

```
{
    "id": 1,
    "station_id": 5325,
    "date": "2020-01-23 12:52:20",
    "temperature": 25.0,
    "dew_point": 20.0,
    "air_pressure_station": 50.0,
```
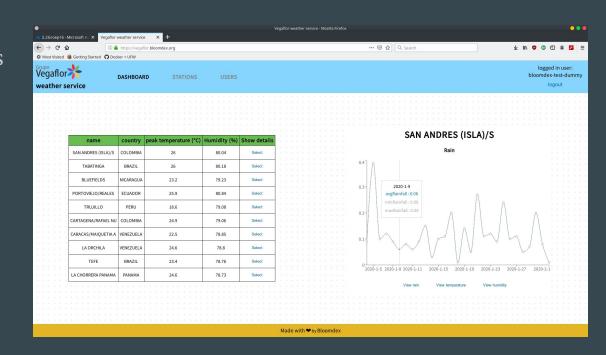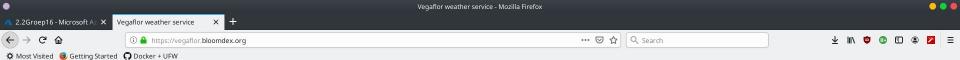
Website

- Logging in
- map with markers
- information about stations
- static
- color scheme
- logo
-

https://vegaflor.bloomdex.org/

2.2Groep16 - Microsoft Az | Vegaflor weather service

https://vegaflor.bloomdex.org

Most Visited | Getting Started | Docker + UFW

Grupo
Vegaflor
weather service

DASHBOARD   STATIONS   USERS

logged in user:
bloomdex-test-dummy

logout

name	country	peak temperature (°C)	Humidity (%)	Show details
SAN ANDRES (ISLA)/S	COLOMBIA	26	80.04	Select
TABATINGA	BRAZIL	26	80.18	Select
BLUEFIELDS	NICARAGUA	23.2	79.23	Select
PORTOVIEJO/REALES	ECUADOR	25.9	80.84	Select
TRUJILLO	PERU	18.6	79.08	Select
CARTAGENA/RAFAEL NU	COLOMBIA	24.9	79.06	Select
CARACAS/MAIQUETIA A	VENEZUELA	22.5	78.85	Select
LA ORCHILA	VENEZUELA	24.6	78.8	Select
TEFE	BRAZIL	23.4	78.76	Select
LA CHORRERA PANAMA	PANAMA	24.6	78.73	Select

SAN ANDRES (ISLA)/S

Rain

2020-1-9
avgRainfall : 0.06
minRainfall : 0.06
maxRainfall : 0.06

0.4

0.3

0.2

0.1

0

2020-1-5 2020-1-8 2020-1-11 2020-1-15 2020-1-19 2020-1-23 2020-1-27 2020-2-1

View rain   View temperature   View humidity

2.2Groep16 - Microsoft Az | Vegaflor weather service

https://vegaflor.bloomdex.org

Most Visited | Getting Started | Docker + UFW

Grupo
Vegaflor
weather service

DASHBOARD STATIONS USERS

logged in user:
bloomdex-test-dummy

logout

name	country	peak temperature (°C)	Humidity (%)	Show details
SAN ANDRES (ISLA)/S	COLOMBIA	26	80.04	Select
TABATINGA	BRAZIL	26	80.18	Select
BLUEFIELDS	NICARAGUA	23.2	79.23	Select
PORTOVIEJO/REALES	ECUADOR	25.9	80.84	Select
TRUJILLO	PERU	18.6	79.08	Select
CARTAGENA/RAFAEL NU	COLOMBIA	24.9	79.06	Select
CARACAS/MAIQUETIA A	VENEZUELA	22.5	78.85	Select
LA ORCHILA	VENEZUELA	24.6	78.8	Select
TEFE	BRAZIL	23.4	78.76	Select
LA CHORRERA PANAMA	PANAMA	24.6	78.73	Select

CARACAS/MAIQUETIA A

Temperature

2020-1-31
avgTemperature : 20.9
minTemperature : 20.4
maxTemperature : 21.7

View rain   View temperature   View humidity

2.2Groep16 - Microsoft Az | Vegaflor weather service | +

https://vegaflor.bloomdex.org/stationviewer | Search

Most Visited | Getting Started | Docker + UFW

Grupo
Vegaflor
weather service

DASHBOARD STATIONS USERS

logged in user:
bloomdex-test-dummy

logout

Map Search

Station details | Latest Measurement | Average measurement today

name	value
id	3624552
stationId	800280
date	2020-02-01 11:13:47
temperature	23.6
dew_point	19.1
air_pressure_station	1010.3
air_pressure_sea	1006.9
visibility	13.2
wind_speed	23.8
wind_direction	29
rainfall	0
snowfall	0
cloud_coverage	6.1
freeze	false
rain	false
snow	false
hail	false
storm	false
tornado	false

Download json | Download xml

Aruba

Barranquilla
Cartagena
Maracaibo

San Cristóbal

Medellín

Ibagué | Bogotá

Santiago de Cali

Colombia

Pigeon | © OpenStreetMap contributors

Zoom in Zoom out

2.2Groep16 - Microsoft Az | Vegaflor weather service

https://vegaflor.bloomdex.org/users

Most Visited Getting Started Docker + UFW

Grupo
Vegaflor
weather service

DASHBOARD   STATIONS   USERS

logged in user:
bloomdex-test-dummy

logout

username	authorities	delete user
bloomdex-test-dummy	ROLE_ROBOT, ROLE_USER, ROLE_ADMIN	Delete
bloomdex-robot	ROLE_ROBOT	Delete
bart	ROLE_USER	Delete

Add user

username:

password:

login

Made with ❤ by Bloomdex

debian : tmux : client — Konsole

```
2020-02-03 19:58:38.071  INFO 1 --- [        Thread-9] org.bloomdex.server.ServerThread      : Add 29869 new measurements to the datab
ase.
2020-02-03 19:58:50.970  INFO 1 --- [        Thread-9] org.bloomdex.server.ServerThread      : Add 29896 new measurements to the datab
ase.
2020-02-03 19:58:56.891  INFO 1 --- [        Thread-9] org.bloomdex.server.ServerThread      : Add 39780 new measurements to the datab
ase.
2020-02-03 19:59:06.243  INFO 1 --- [        Thread-9] org.bloomdex.server.ServerThread      : Add 39864 new measurements to the datab
ase.
2020-02-03 19:59:38.043  INFO 1 --- [        Thread-9] org.bloomdex.server.ServerThread      : Add 39873 new measurements to the datab
ase.
2020-02-03 20:00:00.282  INFO 1 --- [        Thread-9] org.bloomdex.server.ServerThread      : Add 45905 new measurements to the datab
ase.
2020-02-03 20:00:57.210  INFO 1 --- [        Thread-9] org.bloomdex.server.ServerThread      : Add 49852 new measurements to the datab
ase.
2020-02-03 20:01:50.781  INFO 1 --- [        Thread-9] org.bloomdex.server.ServerThread      : Add 49857 new measurements to the datab
ase.
2020-02-03 20:02:05.986 ERROR 1 --- [      Thread-287] org.bloomdex.server.ServerThread      : Exception: Connection reset
2020-02-03 20:02:31.335  INFO 1 --- [        Thread-9] org.bloomdex.server.ServerThread      : Add 49917 new measurements to the datab
ase.
2020-02-03 20:02:58.590  INFO 1 --- [        Thread-9] org.bloomdex.server.ServerThread      : Add 49953 new measurements to the datab
ase.
2020-02-03 20:03:02.135  INFO 1 --- [        Thread-9] org.bloomdex.server.ServerThread      : Add 49942 new measurements to the datab
ase.
2020-02-03 20:03:02.496  INFO 1 --- [        Thread-9] org.bloomdex.server.ServerThread      : Add 5526 new measurements to the databa
se.
2020-02-03 20:03:06.419  INFO 1 --- [        Thread-9] org.bloomdex.server.ServerThread      : Add 50181 new measurements to the datab
ase.
2020-02-03 20:03:10.479  INFO 1 --- [        Thread-9] org.bloomdex.server.ServerThread      : Add 59853 new measurements to the datab
ase.
2020-02-03 20:03:14.640  INFO 1 --- [        Thread-9] org.bloomdex.server.ServerThread      : Add 53939 new measurements to the datab
ase.
2020-02-03 20:04:30.041  INFO 1 --- [        Thread-9] org.bloomdex.server.ServerThread      : Add 59943 new measurements to the datab
ase.
```

```
  1 [||||||||||||||||                              19.3%]   Tasks: 30, 669 thr; 1 running
  2 [|||||||||||||||||||||||||||||||||            42.6%]   Load average: 73.97 27.17 10.07
  3 [||||||||||||||||||||||||||||||               35.2%]   Uptime: 04:53:31
  4 [||||||||||||||||||                            21.8%]
Mem[|||||||||||||||||||||||||||||||           507M/926M]
Swp[                                          30.4M/100.0M]

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
    1 root       20   0 34732  1156   820 S  0.0  0.1  0:23.35 /lib/systemd/systemd --system --deserialize 18
10033 pi         20   0 14596   268   240 S  0.0  0.0  0:00.16  /lib/systemd/systemd --user
10037 pi         20   0 36272    68     0 S  0.0  0.0  0:00.00   (sd-pam)
 4801 root       20   0 10724   396   360 S  0.0  0.0  0:00.04  /usr/sbin/sshd -D
12157 root       20   0 12236   376   360 S  0.0  0.0  0:00.22   sshd: pi [priv]
12167 pi         20   0 12236   720   620 S  0.0  0.1  0:03.17    sshd: pi@pts/0
12170 pi         20   0  8372  1884  1532 S  0.0  0.2  0:00.23     -bash
15512 pi         20   0  8484  3156   R  7.1  0.3  0:19.47      htop
12078 root       20   0 12236   368   360 S  0.0  0.0  0:00.96   sshd: pi [priv]
12088 pi         20   0 12236   712   S  0.0  0.1  0:00.00    sshd: pi@pts/1
12091 pi         20   0  8504  3180  2416 S  0.0  0.3  0:00.88     -bash
15471 pi         20   0 1132M  430M 13788 S 108. 46.5  5:25.10      java -Xms128m -Xmx832m -server -jar pi-weather-station.ja
16233 pi         20   0 1132M  430M 13788 S  0.0 46.5  0:00.03       java -Xms128m -Xmx832m -server -jar pi-weather-station
16230 pi         20   0 1132M  430M 13788 S  0.0 46.5  0:00.03       java -Xms128m -Xmx832m -server -jar pi-weather-station
16229 pi         20   0 1132M  430M 13788 S  0.0 46.5  0:00.02       java -Xms128m -Xmx832m -server -jar pi-weather-station
16228 pi         20   0 1132M  430M 13788 S  0.0 46.5  0:00.02       java -Xms128m -Xmx832m -server -jar pi-weather-station
16227 pi         20   0 1132M  430M 13788 S  0.0 46.5  0:00.03       java -Xms128m -Xmx832m -server -jar pi-weather-station
16225 pi         20   0 1132M  430M 13788 S  0.6 46.5  0:00.03       java -Xms128m -Xmx832m -server -jar pi-weather-station
16224 pi         20   0 1132M  430M 13788 S  0.0 46.5  0:00.03       java -Xms128m -Xmx832m -server -jar pi-weather-station
16223 pi         20   0 1132M  430M 13788 S  0.0 46.5  0:00.03       java -Xms128m -Xmx832m -server -jar pi-weather-station
16222 pi         20   0 1132M  430M 13788 S  0.0 46.5  0:00.03       java -Xms128m -Xmx832m -server -jar pi-weather-station
16220 pi         20   0 1132M  430M 13788 S  0.0 46.5  0:00.03       java -Xms128m -Xmx832m -server -jar pi-weather-station
F1Help  F2Setup  F3Search  F4Filter  F5Sorted  F6Collap  F7Nice -  F8Nice +  F9Kill  F10Quit
```

```
  1 [                                              0.0%]   Tasks: 51, 133 thr; 1 running
  2 [||                                            3.9%]   Load average: 1.92 1.39 0.69
Mem[||||||||||||||||||||||||||||||             1.12G/3.83G]   Uptime: 01:56:27
Swp[                                            0K/0K]

  PID USER      PRI  NI  VIRT   RES   SHR S CPU% MEM%   TIME+  Command
    1 root       20   0 78160  9104  6472 S  0.0  0.2  0:05.05 /sbin/init
11540 uuidd      20   0 28592  1364  1180 S  0.0  0.0  0:00.00  /usr/sbin/uuidd --socket-activation
 6071 bloomdex   20   0 76756  7668  6528 S  0.0  0.2  0:00.03  /lib/systemd/systemd --user
 6072 bloomdex   20   0  109M  2636     8 S  0.0  0.1  0:00.00   (sd-pam)
 1581 root       20   0 72296  6152  5404 S  0.0  0.2  0:00.00  /usr/sbin/sshd -D
 8400 root       20   0  105M  6888  5876 S  0.0  0.2  0:00.01   sshd: bloomdex [priv]
 8485 bloomdex   20   0  105M  3572  2560 S  0.0  0.1  0:00.11    sshd: bloomdex@pts/1
 8486 bloomdex   20   0 21464  4848  3128 S  0.0  0.1  0:00.06     -bash
23044 bloomdex   20   0 32228  4772   R  0.0  0.1  0:00.77      htop -d 5
 6065 root       20   0  105M  6808  5792 S  0.0  0.2  0:00.06   sshd: bloomdex [priv]
 6162 bloomdex   20   0  105M  3364  2348 S  0.0  0.1  0:00.06    sshd: bloomdex@pts/0
 6163 bloomdex   20   0 23232  6712  3152 S  0.0  0.2  0:00.13     -bash
 8086 bloomdex   20   0  585M 54128 29960 S  0.0  1.3  0:00.12      docker logs -f datamcbaseface_desperate_torvalds
 8095 bloomdex   20   0  585M 54128 29960 S  0.0  1.3  0:00.00       docker logs -f datamcbaseface_desperate_torvalds
 8094 bloomdex   20   0  585M 54128 29960 S  0.0  1.3  0:00.02       docker logs -f datamcbaseface_desperate_torvalds
 8093 bloomdex   20   0  585M 54128 29960 S  0.0  1.3  0:00.00       docker logs -f datamcbaseface_desperate_torvalds
 8092 bloomdex   20   0  585M 54128 29960 S  0.0  1.3  0:00.00       docker logs -f datamcbaseface_desperate_torvalds
 8091 bloomdex   20   0  585M 54128 29960 S  0.0  1.3  0:00.03       docker logs -f datamcbaseface_desperate_torvalds
 8090 bloomdex   20   0  585M 54128 29960 S  0.0  1.3  0:00.00       docker logs -f datamcbaseface_desperate_torvalds
 8089 bloomdex   20   0  585M 54128 29960 S  0.0  1.3  0:00.00       docker logs -f datamcbaseface_desperate_torvalds
 1513 root       20   0  282M  6268  5484 S  0.0  0.2  0:00.01  /usr/lib/policykit-1/polkitd --no-debug
 1548 root       20   0  282M  6268  5484 S  0.0  0.2  0:00.00   /usr/lib/policykit-1/polkitd --no-debug
 1537 root       20   0  282M  6268  5484 S  0.0  0.2  0:00.00   /usr/lib/policykit-1/polkitd --no-debug
 1502 root       20   0 16408  2172  2020 S  0.0  0.1  0:00.00  /sbin/agetty -o -p -- \u --noclear tty1 linux
 1489 root       20   0 16408  2172  2020 S  0.0  0.1  0:00.00  /sbin/agetty -o -p -- \u --keep-baud 115200,38400,9600 ttyS0 vt220
F1Help  F2Setup  F3Search  F4Filter  F5Sorted  F6Collap  F7Nice -  F8Nice +  F9Kill  F10Quit
[0] 0:ssh*
```

```
Amount of measurements in the past 10 seconds: 2817415
Amount of measurements in total: 1642945
-----------------------
Timer: Done counting, restarting...
Amount of measurements in the past 10 seconds: 59943
Amount of bytes in the past 10 seconds: 2817321
Amount of measurements in total: 1702888
-----------------------
Timer: Done counting, restarting...
Amount of measurements in the past 10 seconds: 59932
Amount of bytes in the past 10 seconds: 2816804
Amount of measurements in total: 1762820
-----------------------
Timer: Done counting, restarting...
Amount of measurements in the past 10 seconds: 119876
Amount of bytes in the past 10 seconds: 5634172
Amount of measurements in total: 1822764
-----------------------
Timer: Done counting, restarting...
Amount of measurements in the past 10 seconds: 180306
Amount of bytes in the past 10 seconds: 8474382
Amount of measurements in total: 1883194
-----------------------
Timer: Done counting, restarting...
Amount of measurements in the past 10 seconds: 245186
Amount of bytes in the past 10 seconds: 11523742
Amount of measurements in total: 1948074
-----------------------
Timer: Done counting, restarting...
Amount of measurements in the past 10 seconds: 310076
Amount of bytes in the past 10 seconds: 14573572
Amount of measurements in total: 2012964
```

UNWDMI Global Surf...her Data Generator

File

Generator speed

No. Clusters:

1   200   400   600   800   650

Start   Stop

Generator status

Peak temperatures pe...	59
Missing values per sec:	76
Clusters per sec:	650
Active clusters:	650
Disabled clusters:	150
Error clusters:	0

"debian-500-307nd" 21:04 03-Feb-20

(pi) 192.168.1.120 — Konsole

Amount of measurements in total: 1506605
ClientManager: There is no instantiated client present. Remove the NC argument t
o instantiate a client at startup.

Timer: Done counting, restarting...
Amount of measurements in the past 10 seconds: 79443
Amount of bytes in the past 10 seconds: 3752386
Amount of measurements in total: 1586491
ClientManager: There is no instantiated client present. Remove the NC argument t
o instantiate a client at startup.

Timer: Done counting, restarting...
Amount of measurements in the past 10 seconds: 79753
Amount of bytes in the past 10 seconds: 3750835
Amount of measurements in total: 1666301
ClientManager: There is no instantiated client present. Remove the NC argument t
o instantiate a client at startup.

Timer: Done counting, restarting...
Amount of measurements in the past 10 seconds: 79780
Amount of bytes in the past 10 seconds: 3763055
Amount of measurements in total: 1746398
ClientManager: There is no instantiated client present. Remove the NC argument t
o instantiate a client at startup.

Timer: Done counting, restarting...
Amount of measurements in the past 10 seconds: 79837
Amount of bytes in the past 10 seconds: 3752339
Amount of measurements in total: 1826235
ClientManager: There is no instantiated client present. Remove the NC argument to instantiate a client at startup.

Timer: Done counting, restarting...
Amount of measurements in the past 10 seconds: 79644
Amount of bytes in the past 10 seconds: 3745853
Amount of measurements in total: 1905934
ClientManager: There is no instantiated client present. Remove the NC argument to instantiate a client at startup.

Timer: Done counting, restar
Amount of measurements in th
Amount of measurements in th
Amount of bytes in the past
Amount of measurements in to   to instantiate a client at startup.
ClientManager: There is no i

UnwdmiGenerator21-full : java — Konsole

Writing clients: 800 (31)
Calculation: 16
waitForWriting: 0
Total: 48
1580814451803
Writing clients: 800 (29)
Calculation: 16
waitForWriting: 0
Total: 46
1580814452803
Writing clients: 800 (28)
Calculation: 16
waitForWriting: 0
Total: 45
1580814453804
Writing clients: 800 (30)
Calculation: 20
waitForWriting: 0
Total: 51
1580814454804
Writing clients: 800 (31)
Calculation: 21
waitForWriting: 0
Total: 52
1580814455803
Writing clients: 800 (31)
Calculation: 18
waitForWriting: 0
Total: 50
1580814456803
Writing clients: 800 (32)
Calculation: 22
waitForWriting: 0
Total: 54
1580814457803
Writing clients: 800 (32)
Calculation: 29
waitForWriting: 0
Total: 62
1580814458803
Writing clients: 800 (27)
Calculation: 21
waitForWriting: 0
Total: 48
1580814459804
Writing clients: 800 (32)
Calculation: 20
waitForWriting: 0
Total: 53
1580814460803
Writing clients: 800 (32)
Calculation: 16
waitForWriting: 0
Total: 49
1580814461803
Writing clients: 800 (31)
Calculation: 20
waitForWriting: 0
Total: 52
1580814462803
Writing clients: 800 (35)
Calculation: 17
waitForWriting: 0
Total: 52
1580814463803

UNWDMI Global S... Data Generator

File

Generator speed

No. Clusters:

800

1   200   400   600   800

Start   Stop

Generator status
Peak temperatures pe...   79
Missing values per sec: 88
Clusters per sec: 800
Active clusters: 800
Disabled clusters: 0
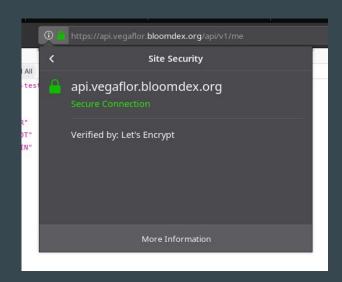Error clusters: 0

Automated nginx reverse proxy

- Runs in a Docker-container on the VPS.
  - https://api.vegaflor.bloomdex.org/ -> http://docker-database:8080/
  - https://vegaflor.bloomdex.org/ -> http://docker-website:80/
- SSL Certificates and renewal using Let's Encrypt

Demo

e-mail: info@bloomdex.org
website: bloomdex.org

End of presentation.