DECENTRALIZED INFRASTRUCTURE MONITORING ON ECLIPSE ZENOH

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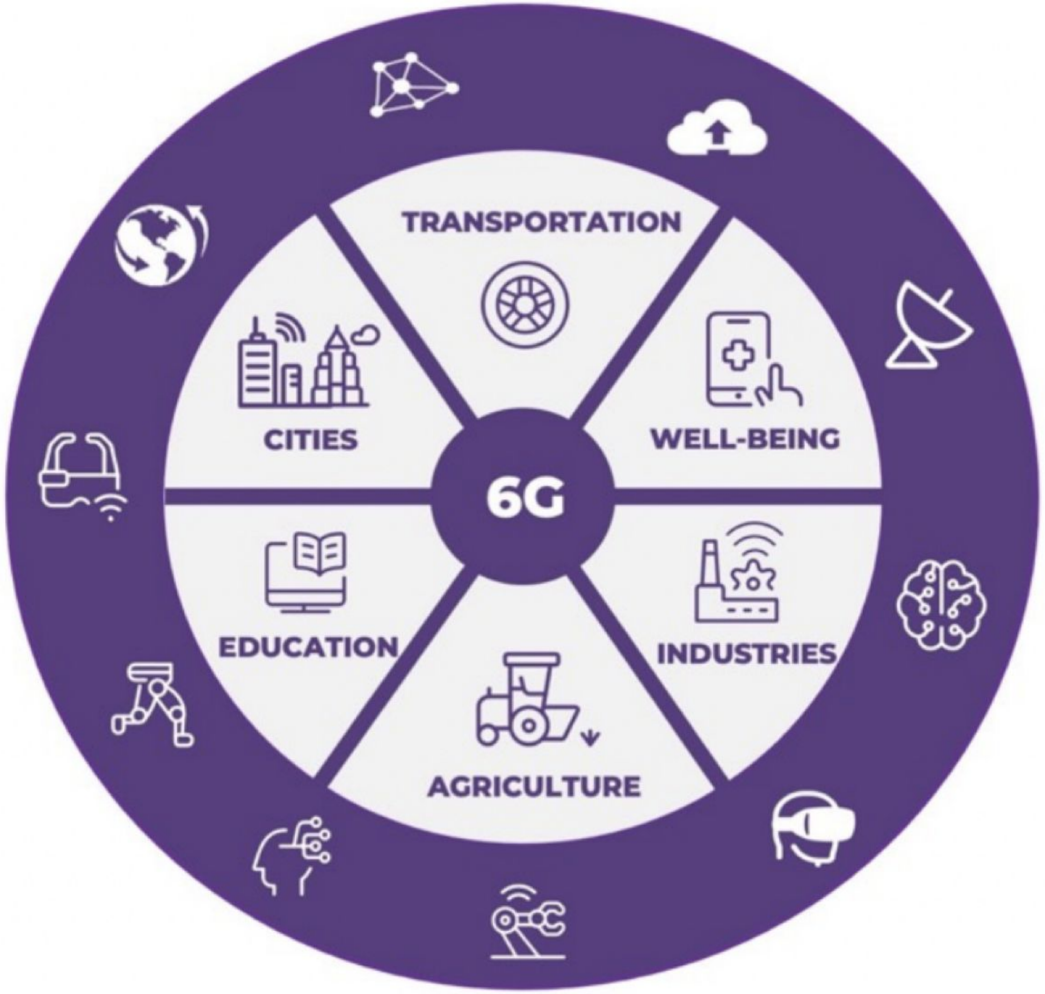
CONTEXT – 6G ECOSYSTEM

The arrival of 6G ecosystem comes with a new set of characteristics:

- Distributed and decentralised infrastructure
- Network infrastructure generates monitoring data
- Data is used to control and optimize the network e.g. via AI
- AI algorithms can run in software defined nodes



PROBLEM STATEMENT

Centralizing all monitoring data to the cloud does not scale

- The amount of generated data requires a distributed paradigm for data distribution and storage

Zenoh

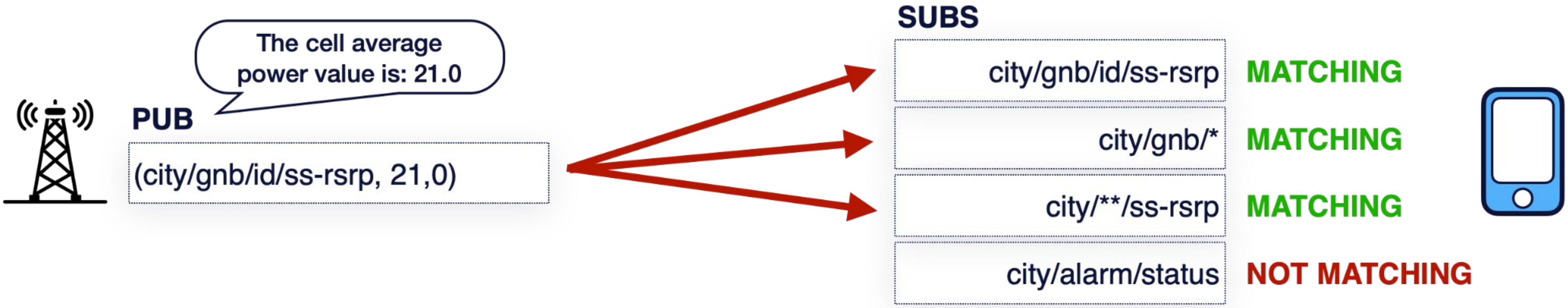
Unifies data in **motion**, data at **rest** and **computations** from **embedded microcontrollers** up to **data centres**

Provides a **location-transparent API** for high performance **pub/sub** and **distributed queries** across **heterogeneous** systems

Facilitates **geo-distributed storage** and **integration with third party technology** in a plug-and-play fashion

PUB/SUB MODEL

Distribute **values published** on a given **key expression** to all the **subscribers matching** that specific key expression



The cell average power value is: 21.0

PUB

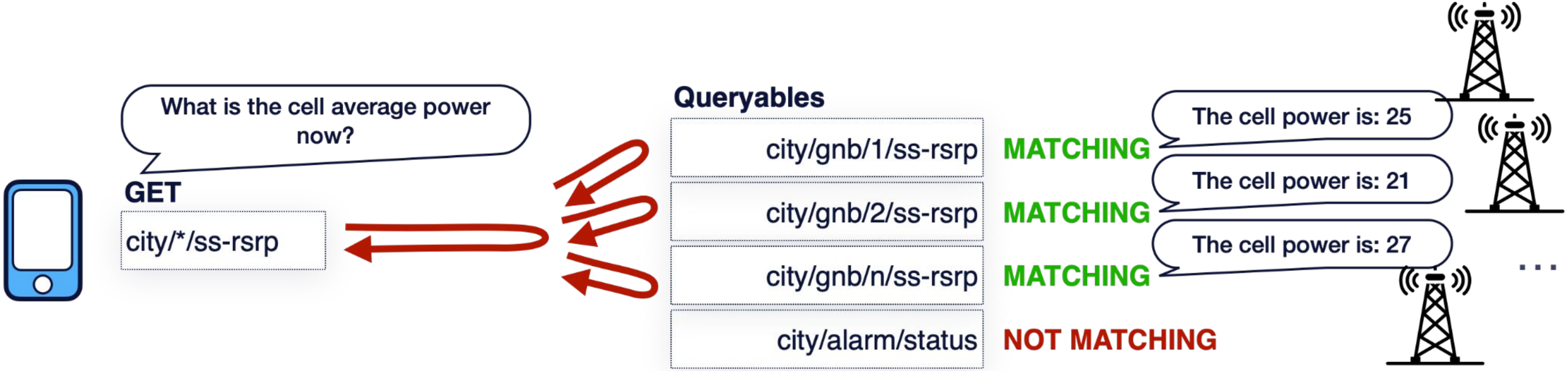
(city/gnb/id/ss-rsrp, 21,0)

SUBS

city/gnb/id/ss-rsrp	MATCHING
city/gnb/*	MATCHING
city/**/ss-rsrp	MATCHING
city/alarm/status	NOT MATCHING

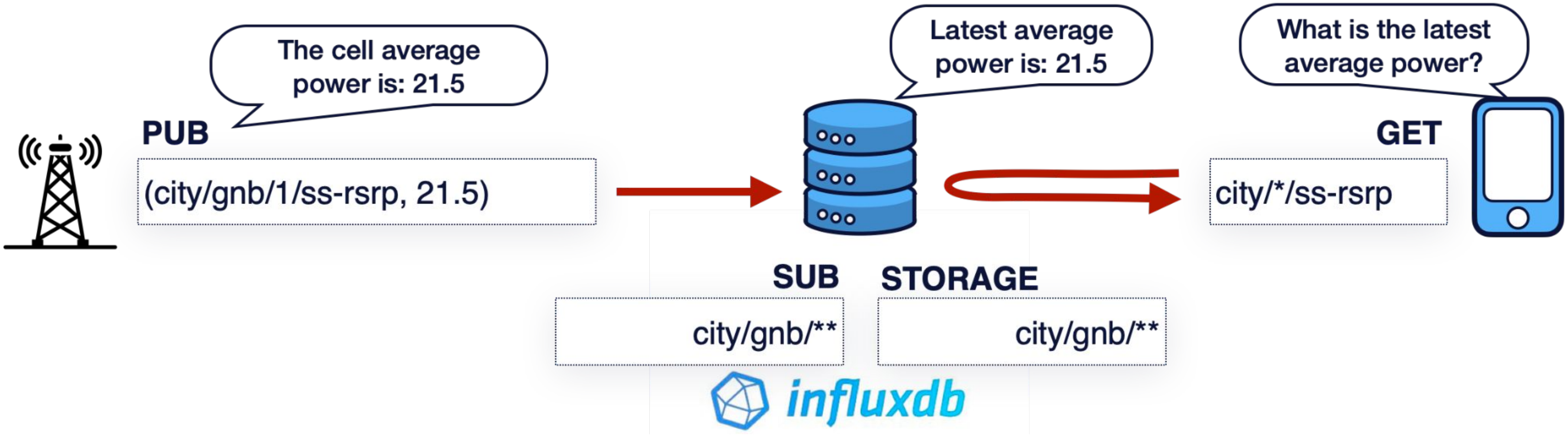
DISTRIBUTED QUERY/QUERYABLE

Request **on-demand computation** of fresh **values** via a **distributed query** matching a given **key expression**



DISTRIBUTED STORAGES

Store **on-demand computation** of fresh **values** via a **distributed query** matching a given **key expression.**


The cell average power is: 21.5
PUB
(city/gnb/1/ss-rsrp, 21.5)
Latest average power is: 21.5
What is the latest average power?
GET
city/*/ss-rsrp
SUB
city/gnb/**
STORAGE
city/gnb/**
influxdb

ANY TOPOLOGY

Peer-to-peer

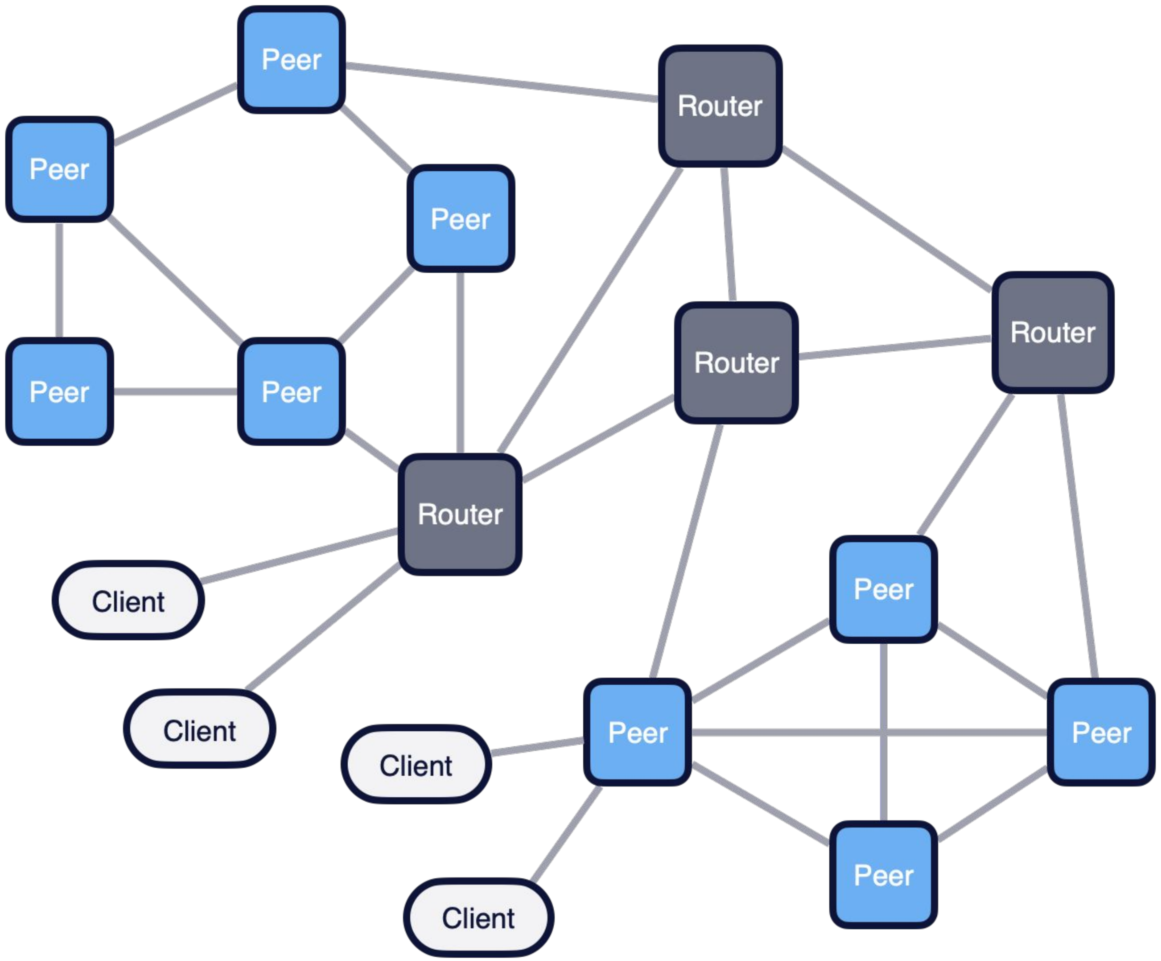
- Clique and mesh topologies

Brokered

- Clients communicate through a router or a peer

Routed

- Routers forward data to and from peers and clients

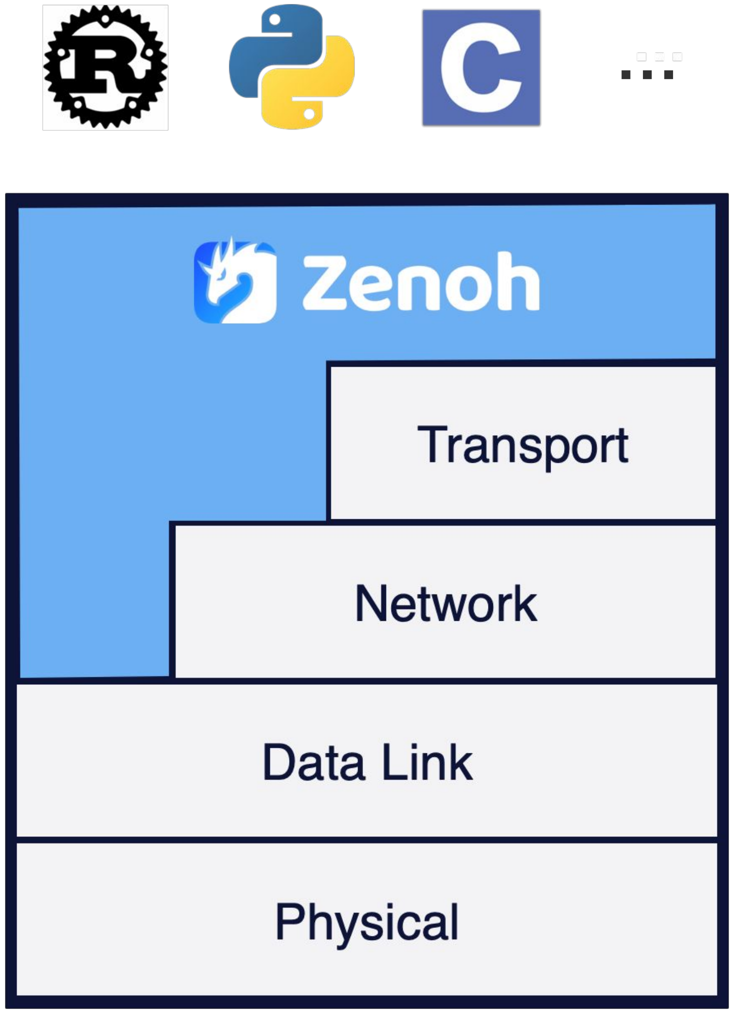


ECLIPSE ZENOH RUNS ANYWHERE

- Native libraries and API bindings for many programming languages

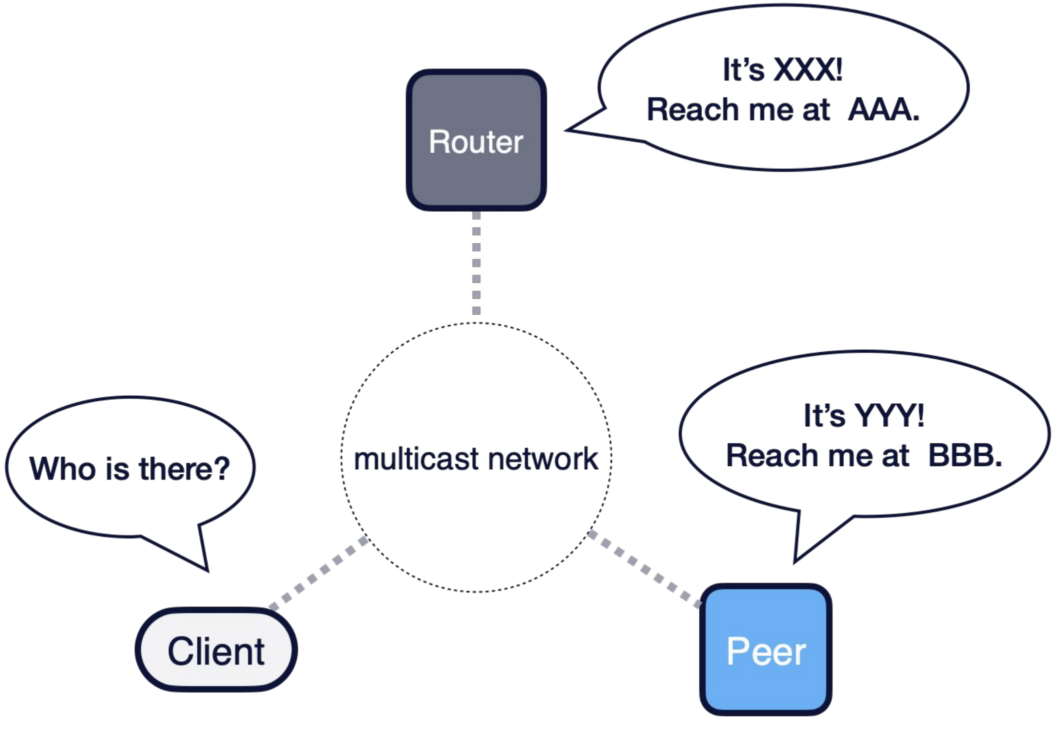
- Over various network technologies: from transport layer to data link

- On embedded and constrained devices



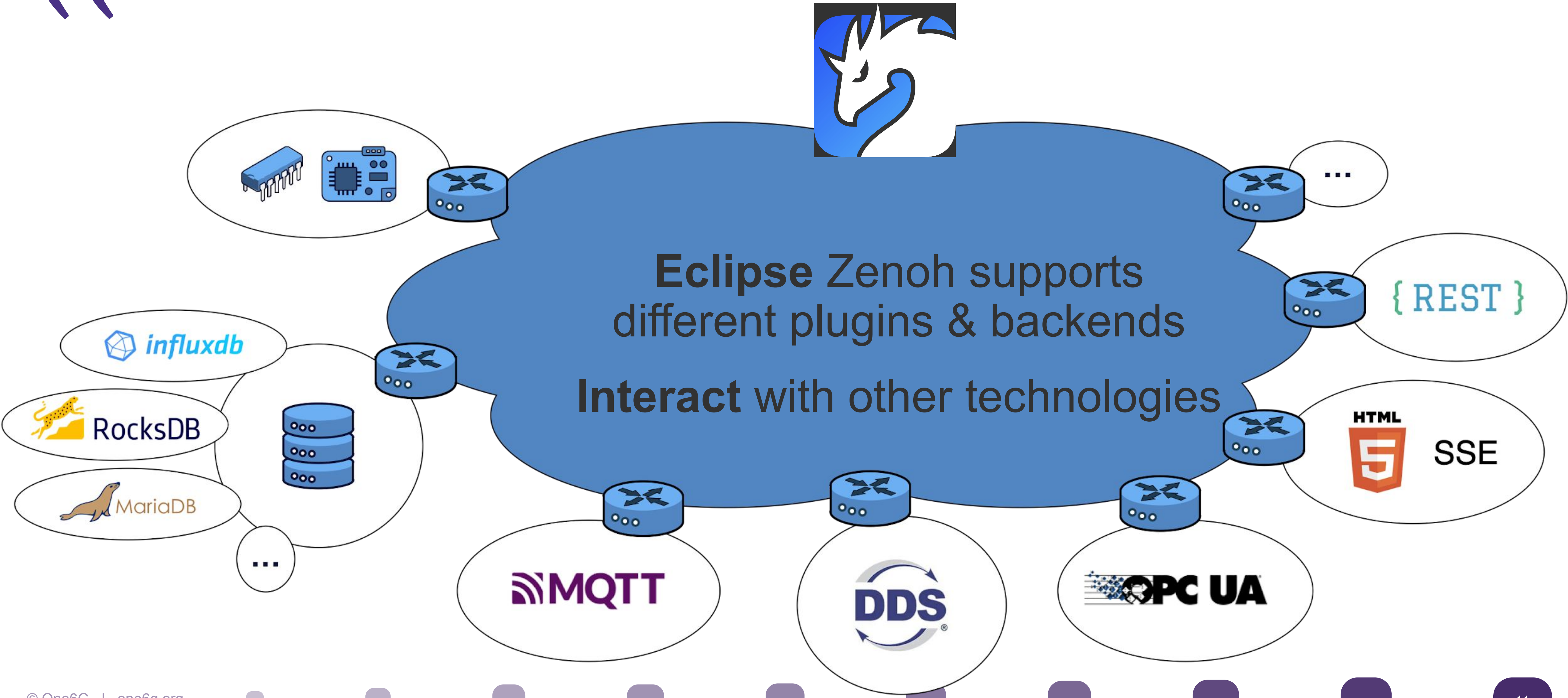
MULTICAST SCOUTING

- Zenoh performs **scouting to discover** other zenoh entities around e.g. routers or peers.
- Zenoh's scouting mechanisms uses the **multicast capabilities** of the underlying network
- When a new zenoh node is **discovered**, then a **zenoh session** can be established



Default IP multicast group: 224.0.0.224
Default UDP scouting port: 7447

EXTENSIBLE: PLUGINS & BACKENDS



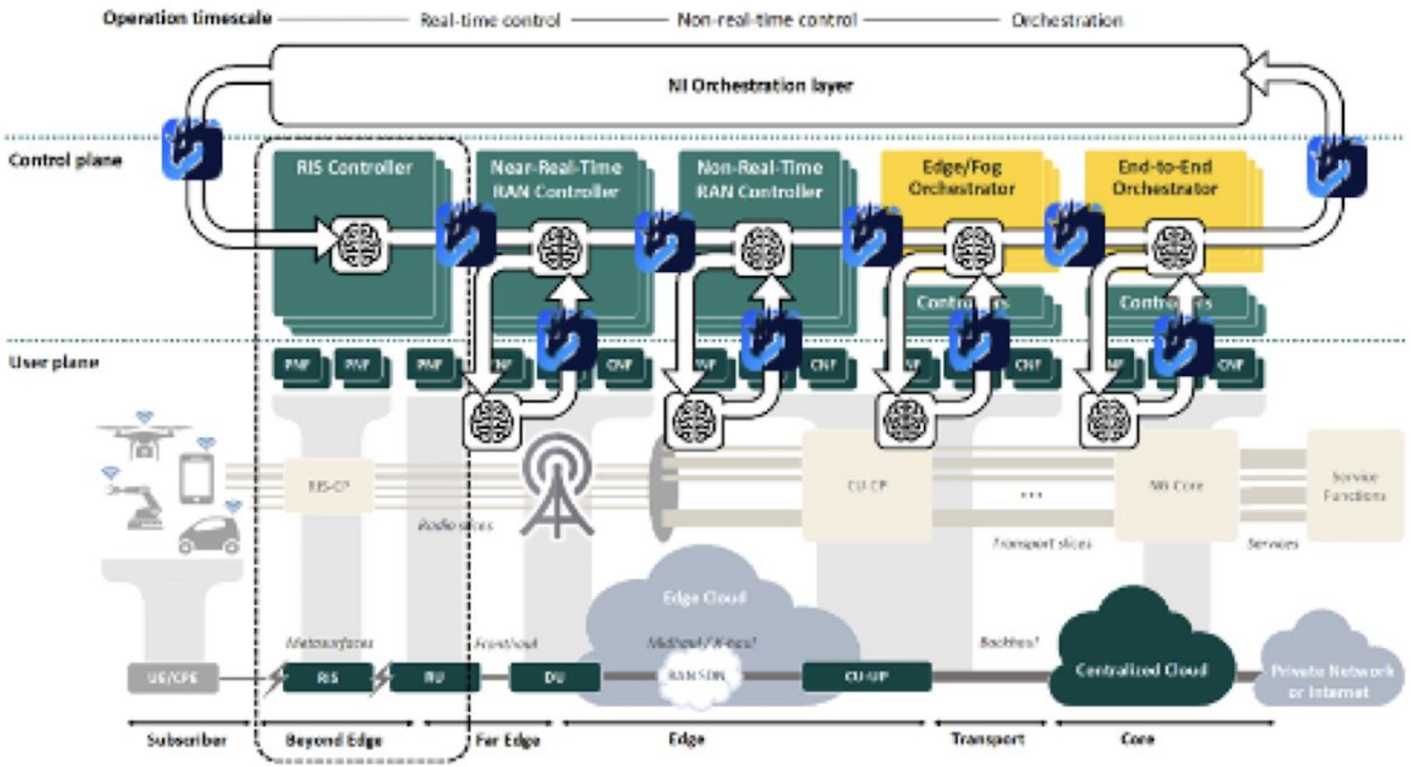
Eclipse Zenoh supports different plugins & backends

Interact with other technologies

DEMO: DISTRIBUTED INFRASTRUCTURE MONITORING WITH ECLIPSE ZENOH

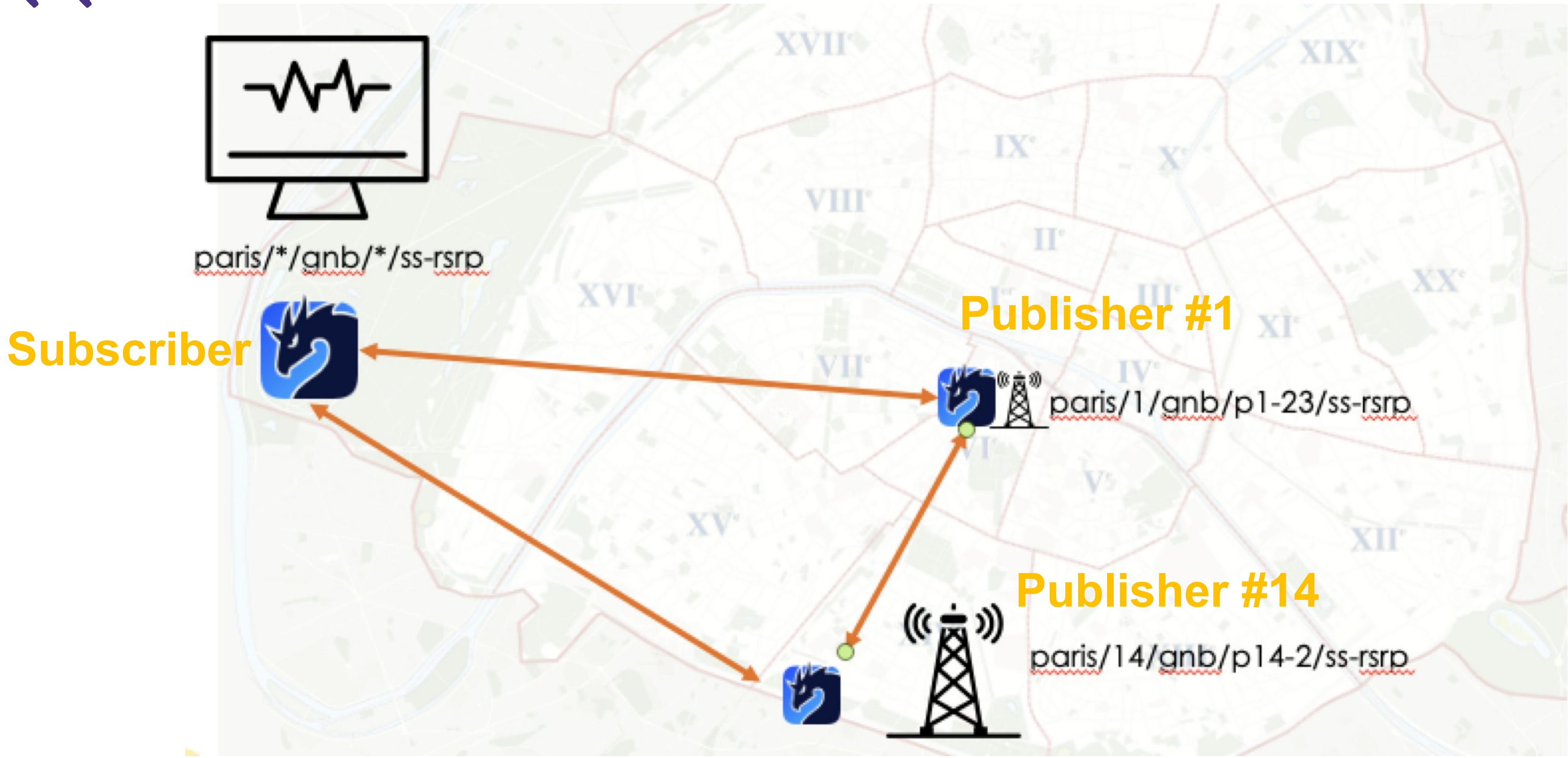
ROLE OF ECLIPSE ZENOH IN ICT52-DAEMON

- Decentralized data pipeline for feed Network Intelligence algorithms
- Support NI algorithms with different time scales across the network infrastructure



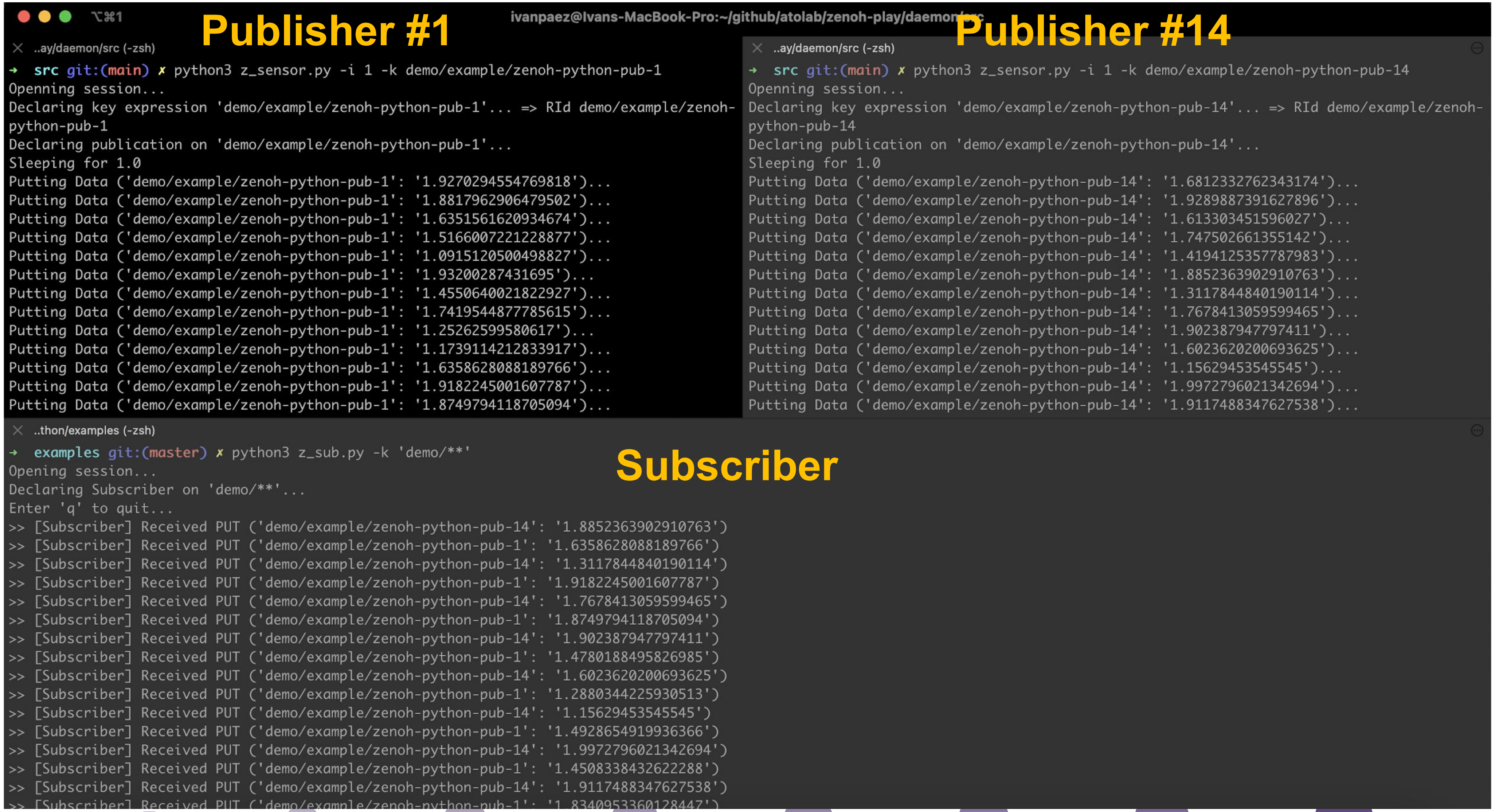
https://h2020daemon.eu/

DECENTRALIZED INFRASTRUCTURE MONITORING



DEMO EXECUTION (PRINTSCREEN OF TERMINALS)

Scenario pub/sub – Data-in-Motion



ivanpaez@Ivans-MacBook-Pro:~/github/atolab/zenoh-play/daemon/src

Publisher #1

..ay/daemon/src (-zsh)

```
➜  src git:(main) ✗ python3 z_sensor.py -i 1 -k demo/example/zenoh-python-pub-1
Openning session...
Declaring key expression 'demo/example/zenoh-python-pub-1'... => RId demo/example/zenoh-
python-pub-1
Declaring publication on 'demo/example/zenoh-python-pub-1'...
Sleeping for 1.0
Putting Data ('demo/example/zenoh-python-pub-1': '1.9270294554769818')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.8817962906479502')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.635156162093467 4')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.5166007221228877')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.0915120500498827')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.93200287431695')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.4550640021822927')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.7419544877785615')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.25262599580617')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.1739114212833917')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.6358628088189766')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.9182245001607787')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.8749794118705094')...
```

Publisher #14

..ay/daemon/src (-zsh)

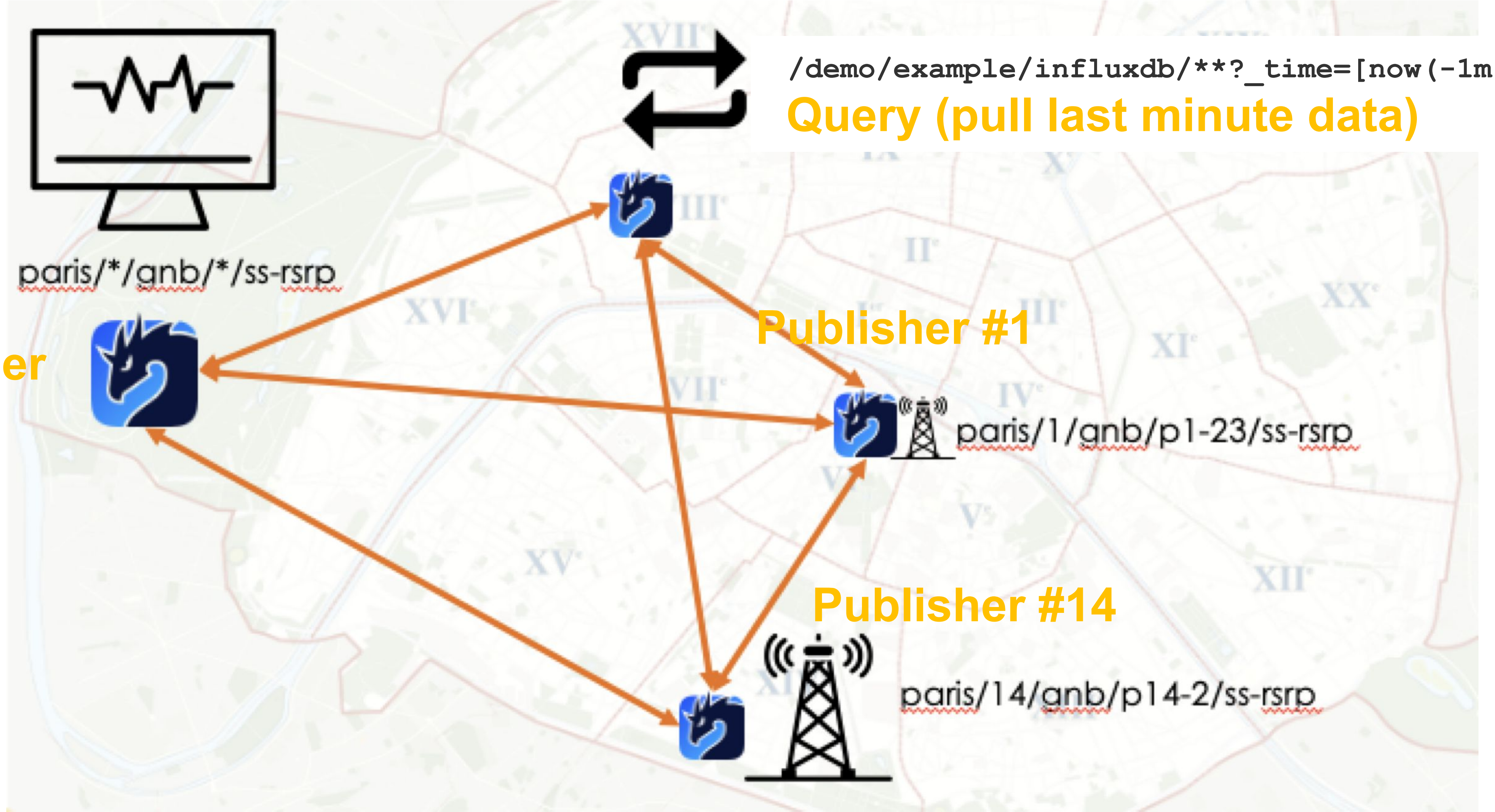
```
➜  src git:(main) ✗ python3 z_sensor.py -i 1 -k demo/example/zenoh-python-pub-14
Openning session...
Declaring key expression 'demo/example/zenoh-python-pub-14'... => RId demo/example/zenoh-
python-pub-14
Declaring publication on 'demo/example/zenoh-python-pub-14'...
Sleeping for 1.0
Putting Data ('demo/example/zenoh-python-pub-14': '1.6812332762343174')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.9289887391627896')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.61330345159602 7')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.747502661355142')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.4194125357787983')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.8852363902910763')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.3117844840190114')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.7678413059599465')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.902387947797411')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.6023620200693625')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.15629453545545')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.9972796021342694')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.9117488347627538')...
```

Subscriber

..thon/examples (-zsh)

```
➜  examples git:(master) ✗ python3 z_sub.py -k 'demo/**'
Opening session...
Declaring Subscriber on 'demo/**'...
Enter 'q' to quit...
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.8852363902910763')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.6358628088189766')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.3117844840190114')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.9182245001607787')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.7678413059599465')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.8749794118705094')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.902387947797411')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.4780188495826985')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.6023620200693625')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.2880344225930513')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.15629453545545')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.4928654919936366')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.9972796021342694')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.4508338432622288')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.9117488347627538')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.8340953360128447')
```

DECENTRALIZED INFRASTRUCTURE MONITORING



`/demo/example/influxdb/**?_time=[now(-1m)..]`

Query (pull last minute data)

paris/*/gnb/*/ss-rsrp

Subscriber

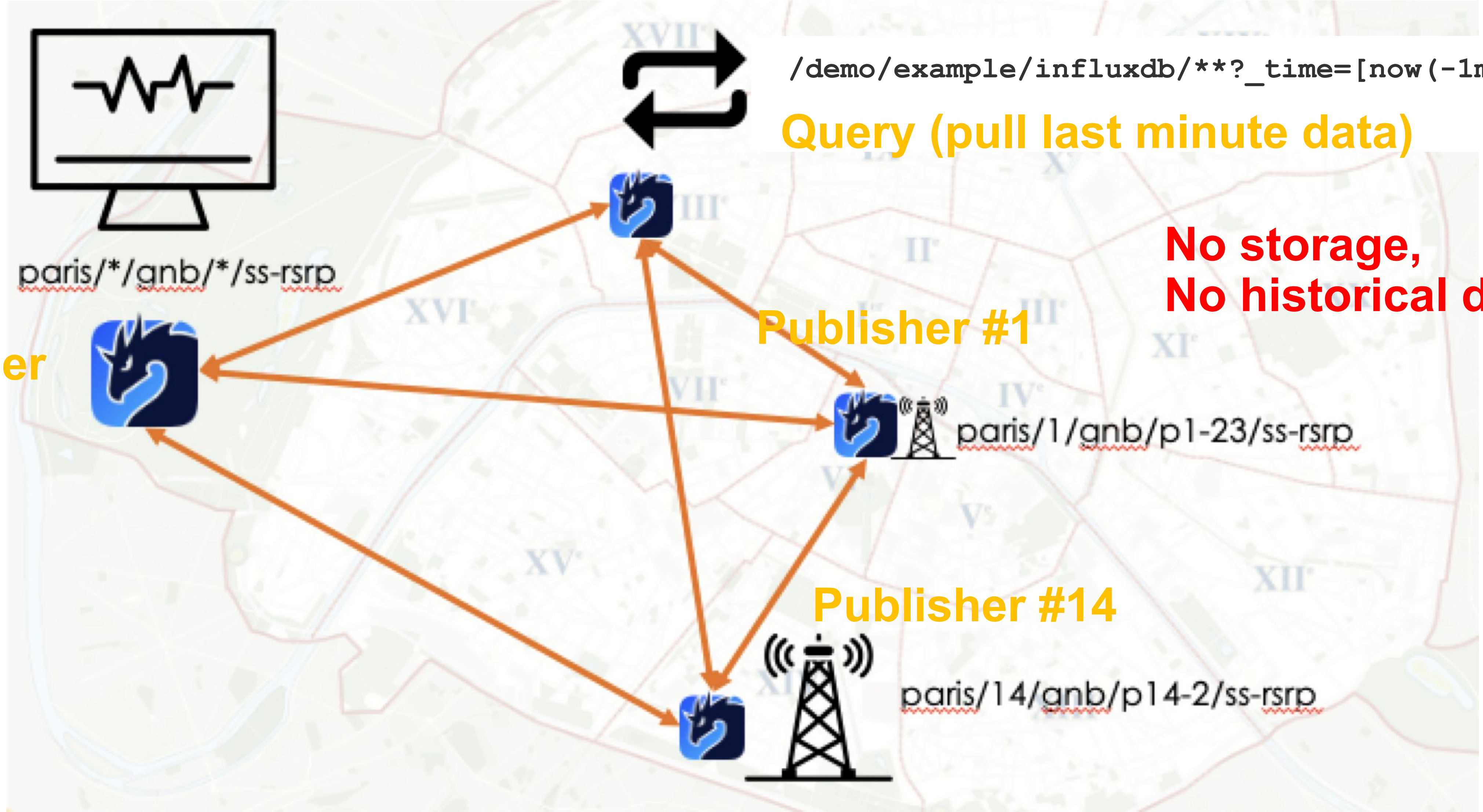
Publisher #1

paris/1/gnb/p1-23/ss-rsrp

Publisher #14

paris/14/gnb/p14-2/ss-rsrp

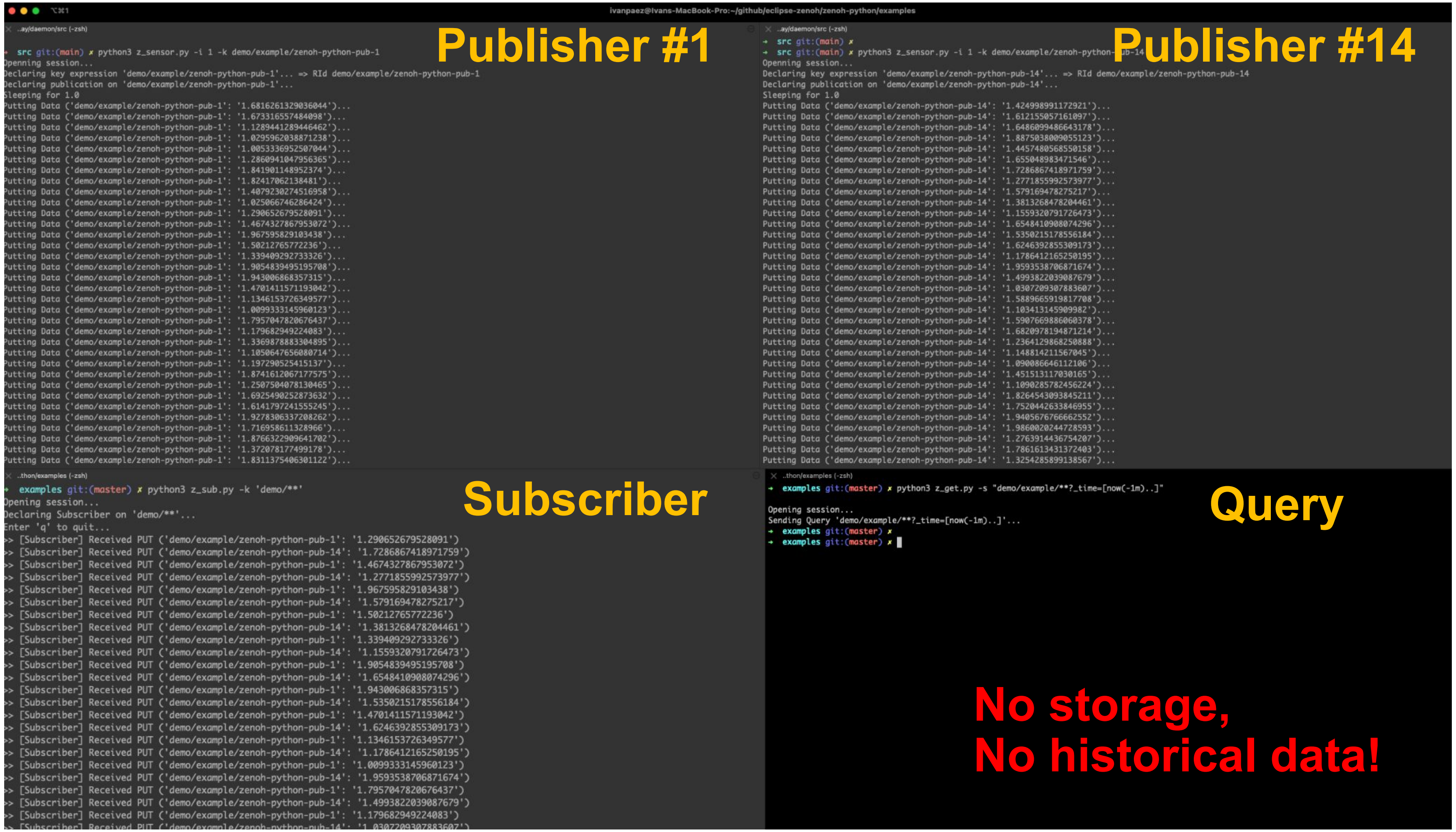
DECENTRALIZED INFRASTRUCTURE MONITORING



/demo/example/influxdb/**?_time=[now(-1m)..]
Query (pull last minute data)
paris/*/gnb/*/ss-rsrp
Subscriber
No storage,
No historical data!
Publisher #1
paris/1/gnb/p1-23/ss-rsrp
Publisher #14
paris/14/gnb/p14-2/ss-rsrp

DEMO EXECUTION (PRINTSCREEN OF TERMINALS)

Scenario get historical data – Data-at-rest



Publisher #1

```
ivanpaez@Ivans-MacBook-Pro:~/github/eclipse-zenoh/zenoh-python/examples
..ay/daemon/src (-zsh)
➜  src git:(main) ✗ python3 z_sensor.py -i 1 -k demo/example/zenoh-python-pub-1
Openning session...
Declaring key expression 'demo/example/zenoh-python-pub-1'... => RId demo/example/zenoh-python-pub-1
Declaring publication on 'demo/example/zenoh-python-pub-1'...
Sleeping for 1.0
Putting Data ('demo/example/zenoh-python-pub-1': '1.6816261329036044')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.673316557484098')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.1289441289446462')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.0295962038871238')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.0053336952507044')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.2860941047956365')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.841901148952374')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.82417062138481')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.4079230274516958')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.025066746286424')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.290652679528091')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.4674327867953072')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.967595829103438')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.50212765772236')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.339409292733326')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.9054839495195708')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.943006868357315')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.4701411571193042')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.1346153726349577')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.0099333145960123')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.7957047820676437')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.179682949224083')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.3369878883304895')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.1050647656080714')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.197290525415137')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.8741612067177575')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.2507504078130465')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.6925490252873632')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.6141797241555245')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.9278306337208262')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.716958611328966')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.8766322909641702')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.372078177499178')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.8311375406301122')...
```

Publisher #14

```
..ay/daemon/src (-zsh)
➜  src git:(main) ✗
➜  src git:(main) ✗ python3 z_sensor.py -i 1 -k demo/example/zenoh-python-pub-14
Openning session...
Declaring key expression 'demo/example/zenoh-python-pub-14'... => RId demo/example/zenoh-python-pub-14
Declaring publication on 'demo/example/zenoh-python-pub-14'...
Sleeping for 1.0
Putting Data ('demo/example/zenoh-python-pub-14': '1.424998991172921')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.612155057161097')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.6486099486643178')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.8875038009055123')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.4457480568550158')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.655048983471546')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.7286867418971759')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.2771855992573977')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.579169478275217')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.3813268478204461')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.1559320791726473')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.6548410908074296')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.5350215178556184')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.6246392855309173')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.1786412165250195')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.9593538706871674')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.4993822039087679')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.0307209307883607')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.5889665919817708')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.103413145909982')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.5907669886060378')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.6820978194871214')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.2364129868250888')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.148814211567045')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.090086646112106')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.451513117030165')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.1090285782456224')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.8264543093845211')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.7520442633846955')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.9405676766662552')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.9860020244728593')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.2763914436754207')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.7861613431372403')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.3254285899138567')...
```

Subscriber

```
..thon/examples (-zsh)
➜  examples git:(master) ✗ python3 z_sub.py -k 'demo/**'
Opening session...
Declaring Subscriber on 'demo/**'...
Enter 'q' to quit...
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.290652679528091')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.7286867418971759')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.4674327867953072')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.2771855992573977')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.967595829103438')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.579169478275217')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.50212765772236')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.3813268478204461')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.339409292733326')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.1559320791726473')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.9054839495195708')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.6548410908074296')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.943006868357315')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.5350215178556184')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.4701411571193042')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.6246392855309173')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.1346153726349577')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.1786412165250195')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.0099333145960123')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.9593538706871674')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.7957047820676437')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.4993822039087679')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.179682949224083')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.0307209307883607')
```

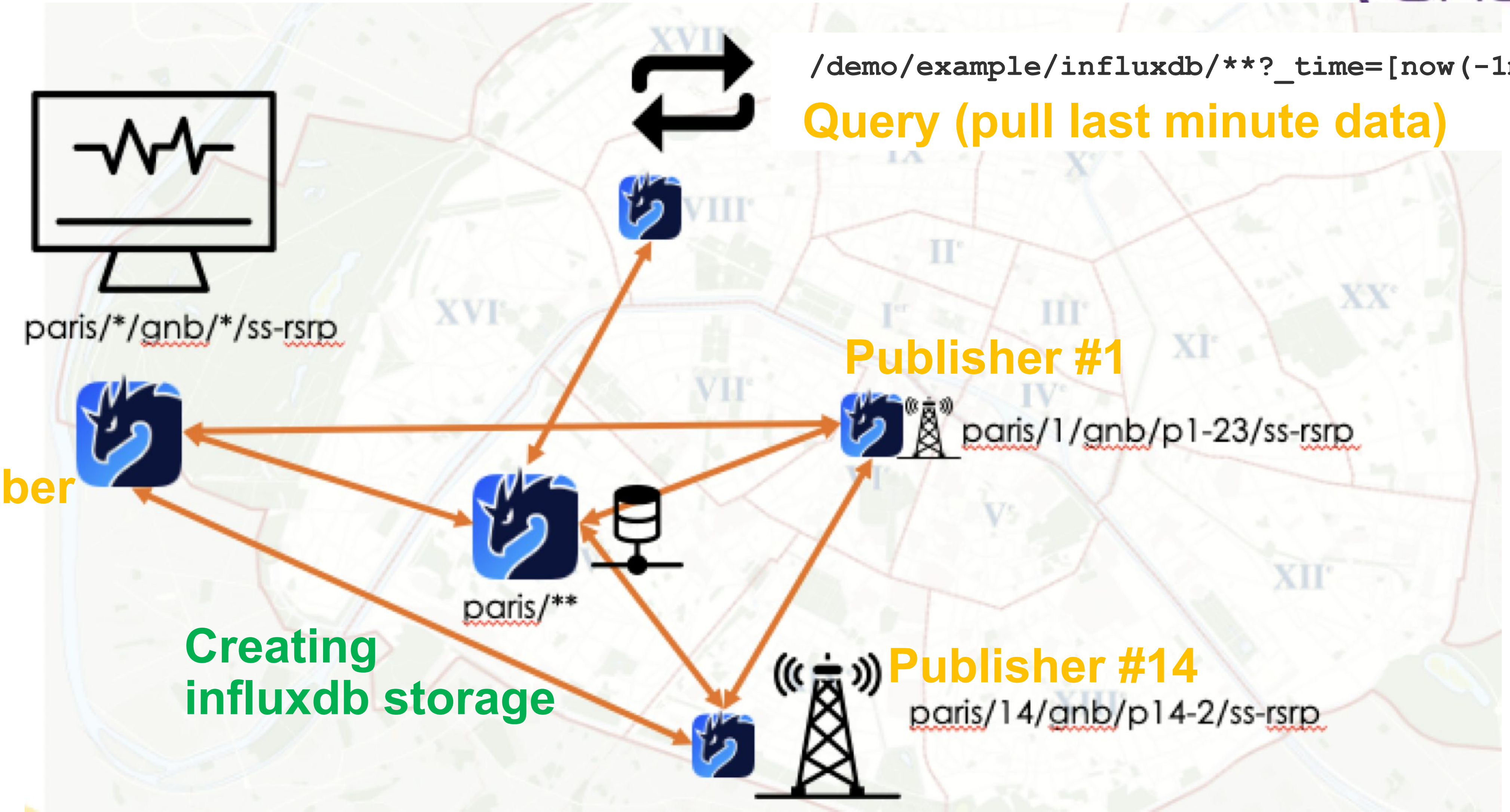
Query

```
..thon/examples (-zsh)
➜  examples git:(master) ✗ python3 z_get.py -s "demo/example/**?_time=[now(-1m)..]"

Opening session...
Sending Query 'demo/example/**?_time=[now(-1m)..]'...
➜  examples git:(master) ✗
➜  examples git:(master) ✗
```

No storage,
No historical data!

DECENTRALIZED INFRASTRUCTURE MONITORING

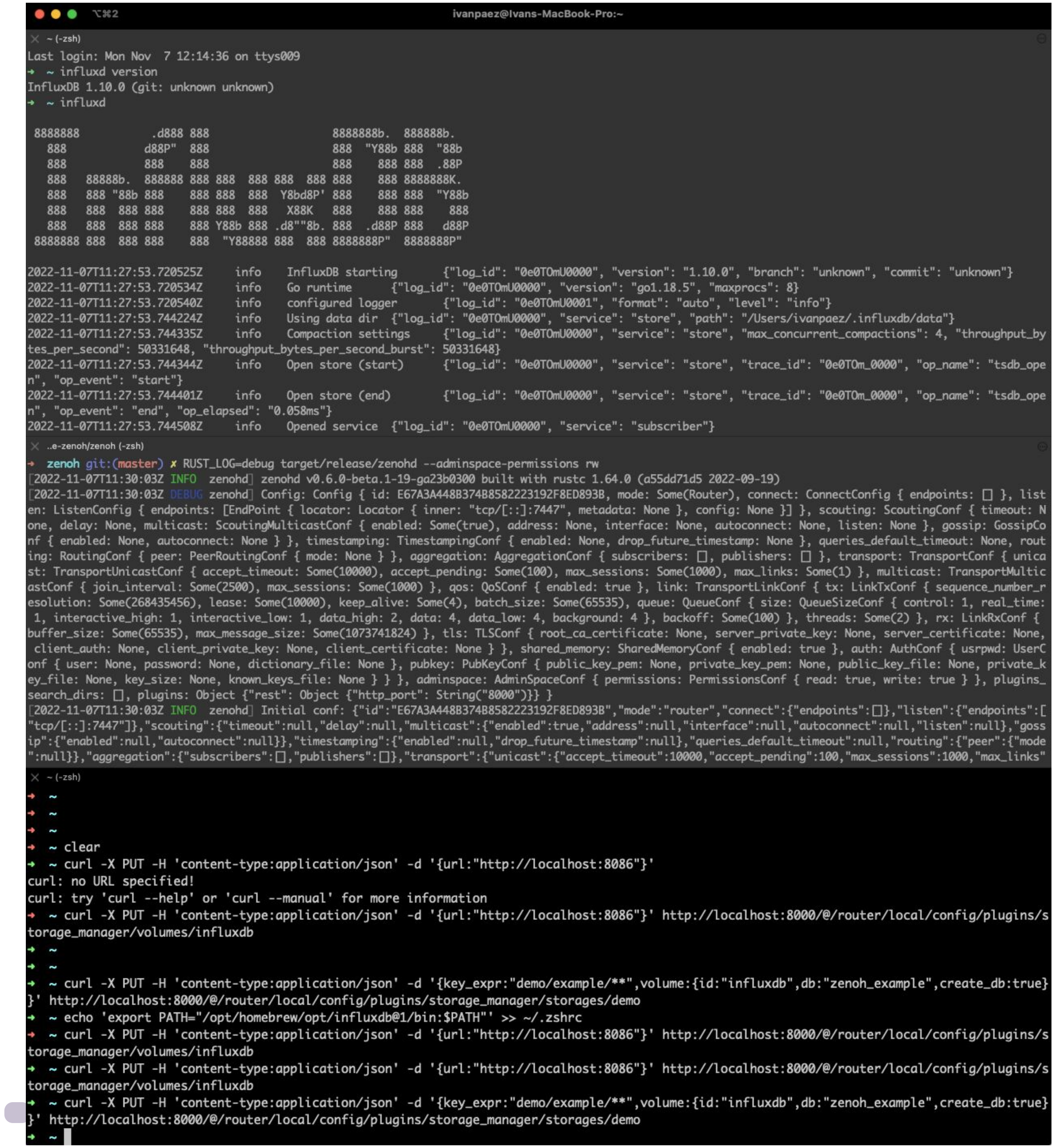


paris/*/gnb/*/ss-rsrp
Subscriber
paris/**
Creating influxdb storage
Publisher #1
paris/1/gnb/p1-23/ss-rsrp
Publisher #14
paris/14/gnb/p14-2/ss-rsrp

```
/demo/example/influxdb/**?_time=[now(-1m)..]
```

Query (pull last minute data)

DECENTRALIZED INFRASTRUCTURE MONITORING



```
⌥⌘2                    ivanpaez@Ivans-MacBook-Pro:~
~ (-zsh)
Last login: Mon Nov  7 12:14:36 on ttys009
➜  ~ influxd version
InfluxDB 1.10.0 (git: unknown unknown)
➜  ~ influxd

 8888888           .d888 888                   8888888b.  888888b.
   888            d88P"  888                   888  "Y88b 888  "88b
   888            888    888                   888    888 888  .88P
   888   88888b.  888888 888 888  888 888  888 888    888 8888888K.
   888   888 "88b 888    888 888  888  Y8bd8P' 888    888 888  "Y88b
   888   888  888 888    888 888  888   X88K   888    888 888    888
   888   888  888 888    888 Y88b 888 .d8""8b. 888  .d88P 888   d88P
 8888888 888  888 888    888  "Y88888 888  888 8888888P"  8888888P"

2022-11-07T11:27:53.720525Z     info    InfluxDB starting       {"log_id": "0e0TOmU0000", "version": "1.10.0", "branch": "unknown", "commit": "unknown"}
2022-11-07T11:27:53.720534Z     info    Go runtime      {"log_id": "0e0TOmU0000", "version": "go1.18.5", "maxprocs": 8}
2022-11-07T11:27:53.720540Z     info    configured logger       {"log_id": "0e0TOmU0001", "format": "auto", "level": "info"}
2022-11-07T11:27:53.744224Z     info    Using data dir  {"log_id": "0e0TOmU0000", "service": "store", "path": "/Users/ivanpaez/.influxdb/data"}
2022-11-07T11:27:53.744335Z     info    Compaction settings     {"log_id": "0e0TOmU0000", "service": "store", "max_concurrent_compactions": 4, "throughput_by
tes_per_second": 50331648, "throughput_bytes_per_second_burst": 50331648}
2022-11-07T11:27:53.744344Z     info    Open store (start)      {"log_id": "0e0TOmU0000", "service": "store", "trace_id": "0e0TOm_0000", "op_name": "tsdb_ope
n", "op_event": "start"}
2022-11-07T11:27:53.744401Z     info    Open store (end)        {"log_id": "0e0TOmU0000", "service": "store", "trace_id": "0e0TOm_0000", "op_name": "tsdb_ope
n", "op_event": "end", "op_elapsed": "0.058ms"}
2022-11-07T11:27:53.744508Z     info    Opened service  {"log_id": "0e0TOmU0000", "service": "subscriber"}
..e-zenoh/zenoh (-zsh)
➜  zenoh git:(master) ✗ RUST_LOG=debug target/release/zenohd --adminspace-permissions rw
[2022-11-07T11:30:03Z INFO  zenohd] zenohd v0.6.0-beta.1-19-ga23b0300 built with rustc 1.64.0 (a55dd71d5 2022-09-19)
[2022-11-07T11:30:03Z DEBUG zenohd] Config: Config { id: E67A3A448B374B8582223192F8ED893B, mode: Some(Router), connect: ConnectConfig { endpoints: [] }, list
en: ListenConfig { endpoints: [EndPoint { locator: Locator { inner: "tcp/[::]:7447", metadata: None }, config: None }] }, scouting: ScoutingConf { timeout: N
one, delay: None, multicast: ScoutingMulticastConf { enabled: Some(true), address: None, interface: None, autoconnect: None, listen: None }, gossip: GossipCo
nf { enabled: None, autoconnect: None } }, timestamping: TimestampingConf { enabled: None, drop_future_timestamp: None }, queries_default_timeout: None, rout
ing: RoutingConf { peer: PeerRoutingConf { mode: None } }, aggregation: AggregationConf { subscribers: [], publishers: [] }, transport: TransportConf { unica
st: TransportUnicastConf { accept_timeout: Some(10000), accept_pending: Some(100), max_sessions: Some(1000), max_links: Some(1) }, multicast: TransportMultic
astConf { join_interval: Some(2500), max_sessions: Some(1000) }, qos: QoSConf { enabled: true }, link: TransportLinkConf { tx: LinkTxConf { sequence_number_r
esolution: Some(268435456), lease: Some(10000), keep_alive: Some(4), batch_size: Some(65535), queue: QueueConf { size: QueueSizeConf { control: 1, real_time:
 1, interactive_high: 1, interactive_low: 1, data_high: 2, data: 4, data_low: 4, background: 4 }, backoff: Some(100) }, threads: Some(2) }, rx: LinkRxConf {
buffer_size: Some(65535), max_message_size: Some(1073741824) }, tls: TLSConf { root_ca_certificate: None, server_private_key: None, server_certificate: None,
 client_auth: None, client_private_key: None, client_certificate: None } }, shared_memory: SharedMemoryConf { enabled: true }, auth: AuthConf { usrpwd: UserC
onf { user: None, password: None, dictionary_file: None }, pubkey: PubKeyConf { public_key_pem: None, private_key_pem: None, public_key_file: None, private_k
ey_file: None, key_size: None, known_keys_file: None } } }, adminspace: AdminSpaceConf { permissions: PermissionsConf { read: true, write: true } }, plugins_
search_dirs: [], plugins: Object {"rest": Object {"http_port": String("8000")}} }
[2022-11-07T11:30:03Z INFO  zenohd] Initial conf: {"id":"E67A3A448B374B8582223192F8ED893B","mode":"router","connect":{"endpoints":[]},"listen":{"endpoints":[
"tcp/[::]:7447"]},"scouting":{"timeout":null,"delay":null,"multicast":{"enabled":true,"address":null,"interface":null,"autoconnect":null,"listen":null},"goss
ip":{"enabled":null,"autoconnect":null}},"timestamping":{"enabled":null,"drop_future_timestamp":null},"queries_default_timeout":null,"routing":{"peer":{"mode
":null}},"aggregation":{"subscribers":[],"publishers":[]},"transport":{"unicast":{"accept_timeout":10000,"accept_pending":100,"max_sessions":1000,"max_links"
~ (-zsh)
➜  ~
➜  ~
➜  ~
➜  ~ clear
➜  ~ curl -X PUT -H 'content-type:application/json' -d '{url:"http://localhost:8086"}'
curl: no URL specified!
curl: try 'curl --help' or 'curl --manual' for more information
➜  ~ curl -X PUT -H 'content-type:application/json' -d '{url:"http://localhost:8086"}' http://localhost:8000/@/router/local/config/plugins/s
torage_manager/volumes/influxdb
➜  ~
➜  ~
➜  ~ curl -X PUT -H 'content-type:application/json' -d '{key_expr:"demo/example/**",volume:{id:"influxdb",db:"zenoh_example",create_db:true}
}' http://localhost:8000/@/router/local/config/plugins/storage_manager/storages/demo
➜  ~ echo 'export PATH="/opt/homebrew/opt/influxdb@1/bin:$PATH"' >> ~/.zshrc
➜  ~ curl -X PUT -H 'content-type:application/json' -d '{url:"http://localhost:8086"}' http://localhost:8000/@/router/local/config/plugins/s
torage_manager/volumes/influxdb
➜  ~ curl -X PUT -H 'content-type:application/json' -d '{url:"http://localhost:8086"}' http://localhost:8000/@/router/local/config/plugins/s
torage_manager/volumes/influxdb
➜  ~ curl -X PUT -H 'content-type:application/json' -d '{key_expr:"demo/example/**",volume:{id:"influxdb",db:"zenoh_example",create_db:true}
}' http://localhost:8000/@/router/local/config/plugins/storage_manager/storages/demo
➜  ~
```

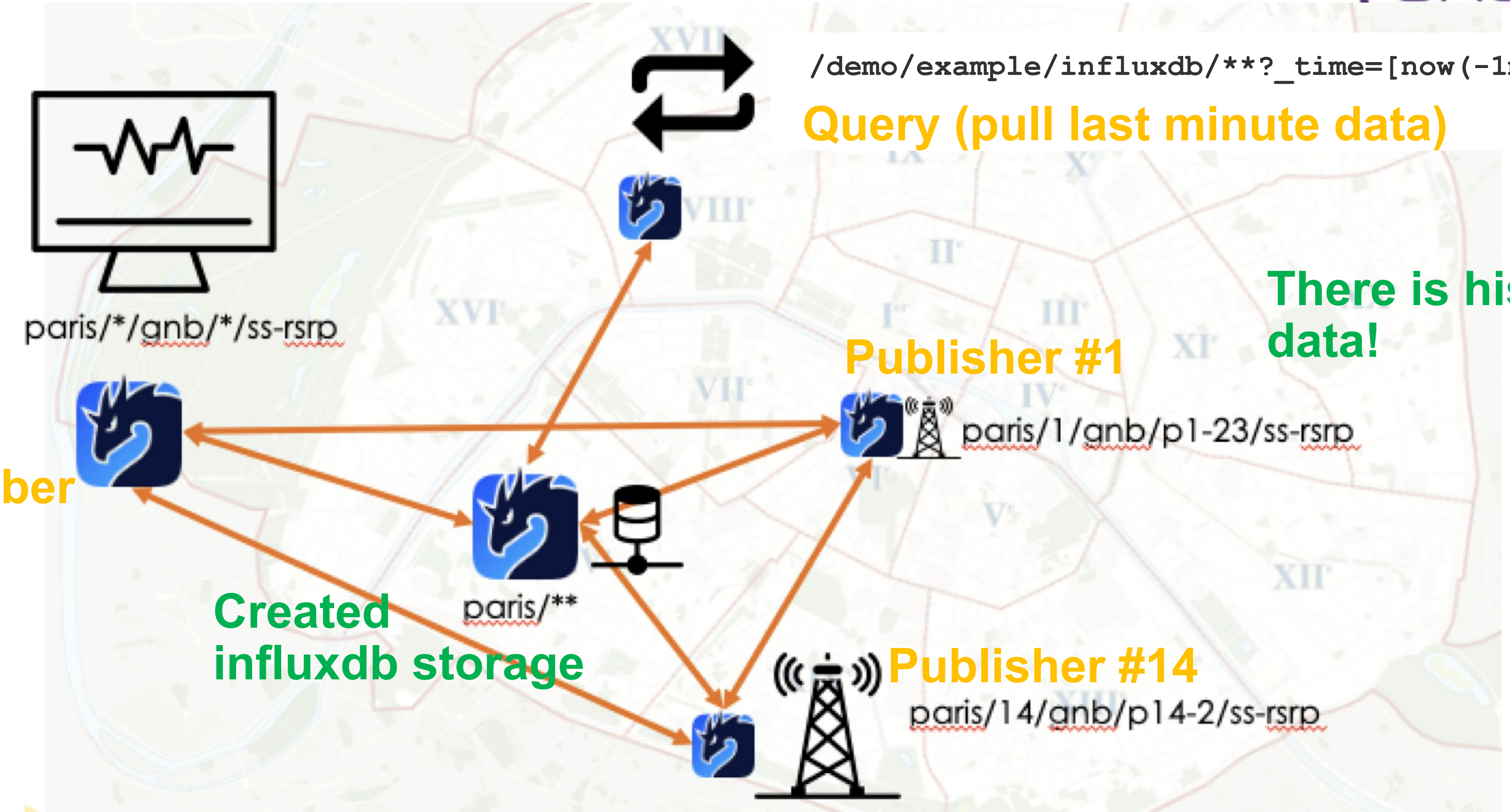
1. Start influxdb

2.Start Zenohd with adminscape permissions

3. Create the “influxdb” volume

4. Create the "demo/example/**" storage

DECENTRALIZED INFRASTRUCTURE MONITORING



```
/demo/example/influxdb/**?_time=[now(-1m)..]
```

Query (pull last minute data)

paris/*/gnb/*/ss-rsrp

Subscriber

Publisher #1

paris/1/gnb/p1-23/ss-rsrp

There is historical data!

paris/**

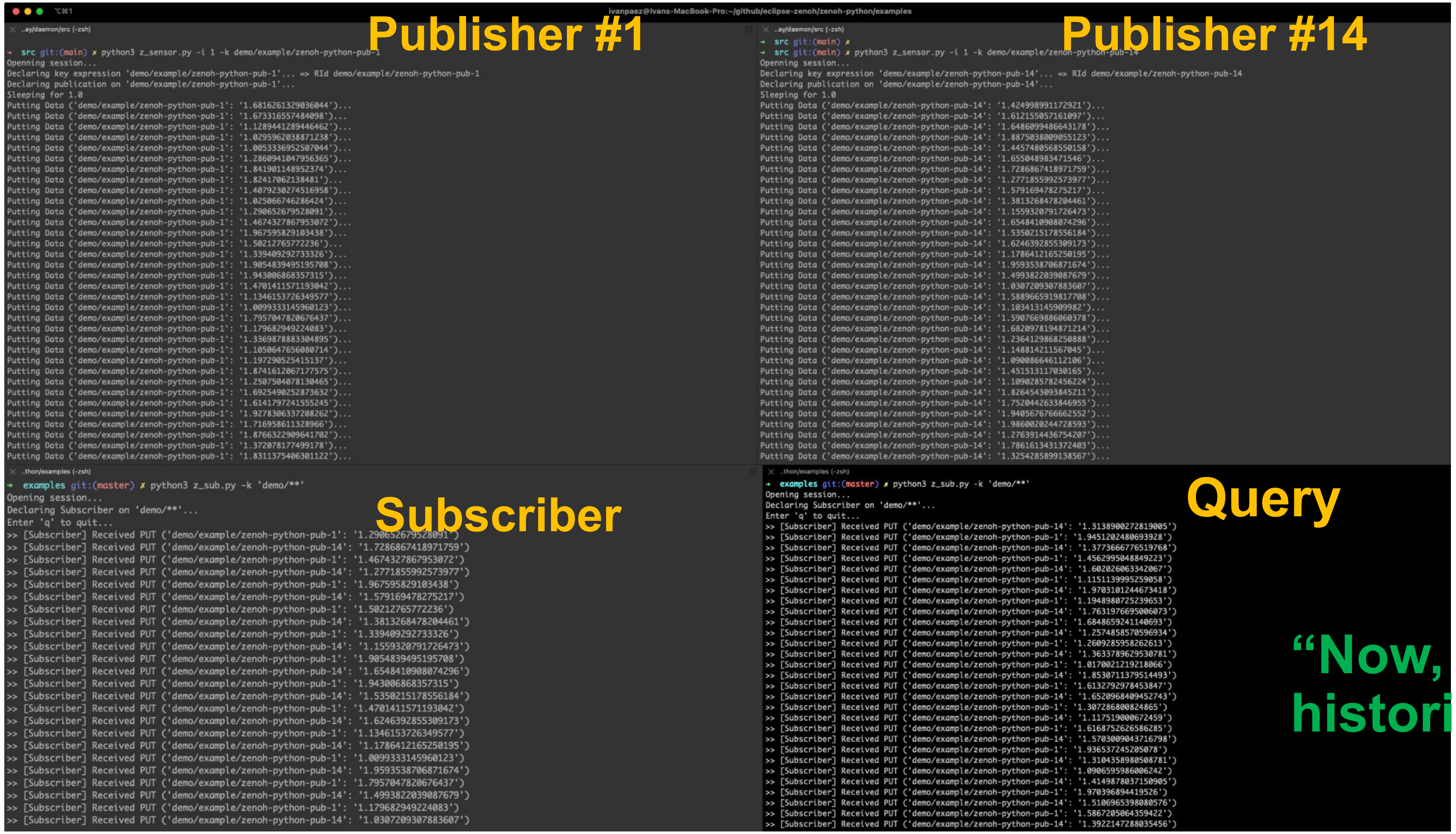
Created influxdb storage

Publisher #14

paris/14/gnb/p14-2/ss-rsrp

DEMO EXECUTION (PRINTSCREEN OF TERMINALS)

Scenario get historical data – using the "influxdb" storage



Publisher #1

Publisher #14

Subscriber

Query

```
ivanpaez@Ivans-MacBook-Pro:~/github/eclipse-zenoh/zenoh-python/examples
```

Publisher #1

```
..ay/daemon/src (-zsh)
→  src git:(main) ✗ python3 z_sensor.py -i 1 -k demo/example/zenoh-python-pub-1
Openning session...
Declaring key expression 'demo/example/zenoh-python-pub-1'... => RId demo/example/zenoh-python-pub-1
Declaring publication on 'demo/example/zenoh-python-pub-1'...
Sleeping for 1.0
Putting Data ('demo/example/zenoh-python-pub-1': '1.6816261329036044')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.673316557484098')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.1289441289446462')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.0295962038871238')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.0053336952507044')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.2860941047956365')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.841901148952374')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.82417062138481')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.4079230274516958')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.025066746286424')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.290652679528091')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.4674327867953072')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.967595829103438')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.50212765772236')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.339409292733326')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.9054839495195708')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.943006868357315')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.4701411571193042')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.1346153726349577')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.0099333145960123')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.7957047820676437')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.179682949224083')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.3369878883304895')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.1050647656080714')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.197290525415137')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.8741612067177575')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.2507504078130465')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.6925490252873632')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.6141797241555245')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.9278306337208262')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.716958611328966')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.8766322909641702')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.372078177499178')...
Putting Data ('demo/example/zenoh-python-pub-1': '1.8311375406301122')...
```

Publisher #14

```
..ay/daemon/src (-zsh)
→  src git:(main) ✗
→  src git:(main) ✗ python3 z_sensor.py -i 1 -k demo/example/zenoh-python-pub-14
Openning session...
Declaring key expression 'demo/example/zenoh-python-pub-14'... => RId demo/example/zenoh-python-pub-14
Declaring publication on 'demo/example/zenoh-python-pub-14'...
Sleeping for 1.0
Putting Data ('demo/example/zenoh-python-pub-14': '1.424998991172921')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.612155057161097')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.6486099486643178')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.8875038009055123')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.4457480568550158')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.655048983471546')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.7286867418971759')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.2771855992573977')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.579169478275217')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.3813268478204461')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.1559320791726473')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.6548410908074296')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.5350215178556184')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.6246392855309173')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.1786412165250195')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.9593538706871674')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.4993822039087679')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.0307209307883607')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.5889665919817708')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.103413145909982')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.5907669886060378')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.6820978194871214')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.2364129868250888')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.148814211567045')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.090086646112106')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.451513117030165')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.1090285782456224')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.8264543093845211')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.7520442633846955')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.9405676766662552')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.9860020244728593')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.2763914436754207')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.7861613431372403')...
Putting Data ('demo/example/zenoh-python-pub-14': '1.3254285899138567')...
```

Subscriber

```
..thon/examples (-zsh)
→  examples git:(master) ✗ python3 z_sub.py -k 'demo/**'
Opening session...
Declaring Subscriber on 'demo/**'...
Enter 'q' to quit...
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.290652679528091')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.7286867418971759')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.4674327867953072')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.2771855992573977')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.967595829103438')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.579169478275217')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.50212765772236')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.3813268478204461')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.339409292733326')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.1559320791726473')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.9054839495195708')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.6548410908074296')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.943006868357315')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.5350215178556184')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.4701411571193042')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.6246392855309173')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.1346153726349577')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.1786412165250195')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.0099333145960123')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.9593538706871674')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.7957047820676437')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.4993822039087679')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.179682949224083')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.0307209307883607')
```

Query

```
..thon/examples (-zsh)
→  examples git:(master) ✗ python3 z_sub.py -k 'demo/**'
Opening session...
Declaring Subscriber on 'demo/**'...
Enter 'q' to quit...
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.3138900272819005')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.9451202480693928')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.3773666776519768')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.4562995048849223')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.602026063342067')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.1151139995259058')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.9703101244673418')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.194898072523965 3')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.7631976695006073')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.684865924114069 3')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.2574858570596934')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.2609285958262613')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.3633789629530781')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.0170021219218066')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.8530711379514493')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.6132792978453847')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.6520968409452743')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.307286800824865')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.117519000672459')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.6168752626586285')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.5703009043716798')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.93653724520507 8')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.3104358980508781')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.0906595986006242')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.4149878037150905')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.970396894419526')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.5106965398080576')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-1': '1.5867205064359422')
>> [Subscriber] Received PUT ('demo/example/zenoh-python-pub-14': '1.3922147288035456')
```

"Now, There is historical data!

ECLIPSE ZENOH HANDLES

- Website: www.zenoh.io
- Official Repository: http://github.com/eclipse-zenoh/zenoh
- Discord Server: https://discord.gg/vSDSpqnbkm
- Roadmap: https://github.com/eclipse-zenoh/roadmap

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OTE

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WINGS
ICT SOLUTIONS

zetta scale

imec

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no.101017109 "DAEMON"

(one6G)

THANK YOU FOR YOUR ATTENTION

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