

IC@MS with EPICS Tango Bridge

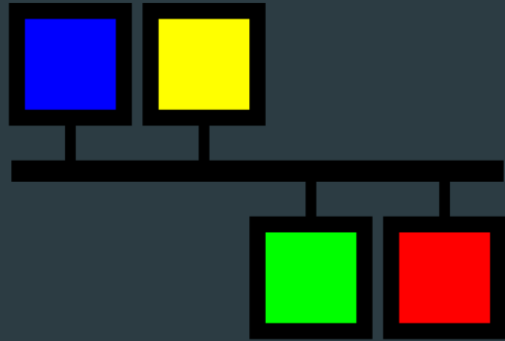
EPICS Collaboration Meeting September 2022

S2Innovation (Poland, Cracow)

Presentation: Mateusz Nabywaniec

EPICS vs Tango

EPICS



EPICS Controls:

- Main unit - IOC
- PV - piece of data associated with some device parameter

?



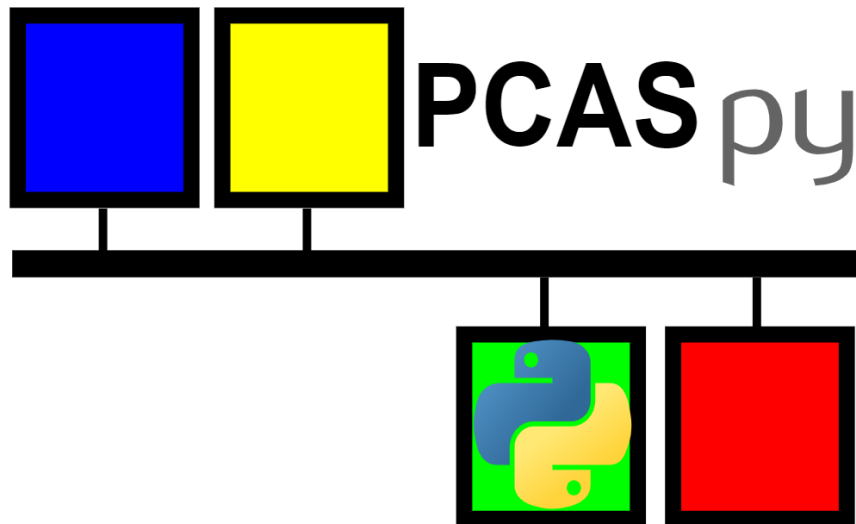
Tango Controls:

- Main unit are Device Servers
- Each device server can have some attributes
- Popular support for thousands of devices

<https://www.tango-controls.org/developers/dsc/>

Solution: EPICS TANGO Bridge

- ▶ Tool to access Tango Classes via EPICS Channel Access
- ▶ Server that provides mapping between Tango Attributes and Commands.
- ▶ Implemented using **pcaspy** (<https://pcaspy.readthedocs.io/en/latest/>)
- ▶ Documentation: <https://epics-tango-bridge.readthedocs.io/en/latest/>



How to use it works? - read

- ▶ To start IOC you need to provide pvdb.py file defining mapping Tango devices

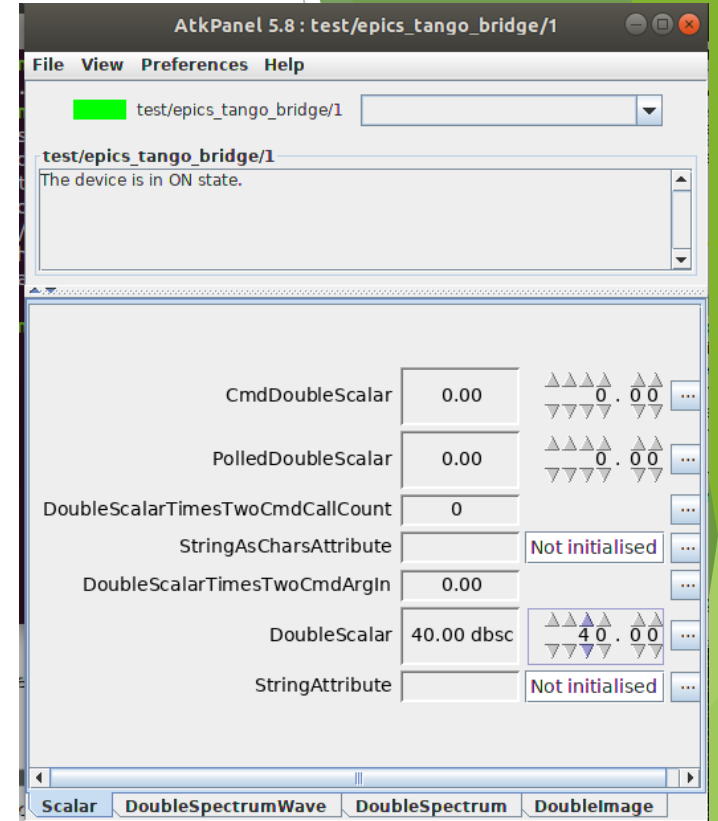
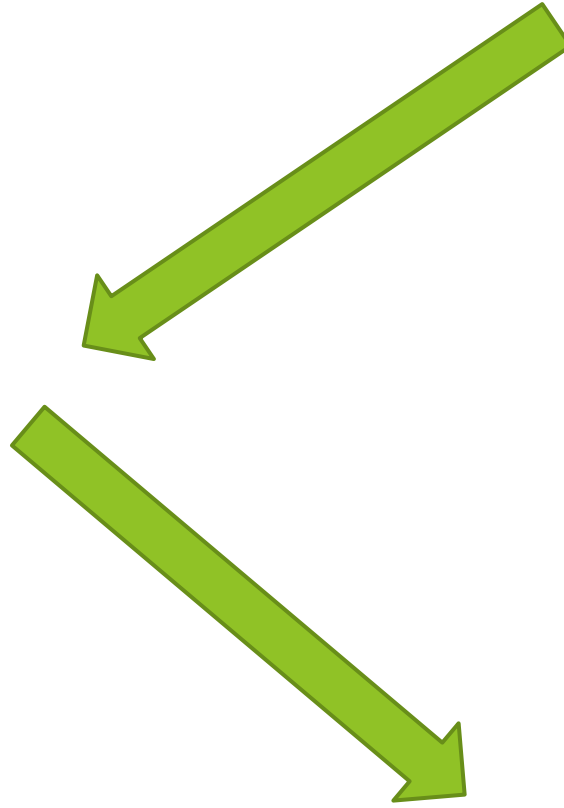
```
epics-tango-bridge ./path/to/pvdb.py
```

```
import PyTango as tango

device = "test/epics_tango_bridge/1"

pvdb = [
    f"{device}:attr:DoubleScalar": {
        'type': 'float',
        'scan': 1,
        'asyn': True,
        'high': 100000.0,
        'hihi': 200000.0,
    },
    f"{device}:attr:StringAttribute": {
        'type': 'string',
        'asyn': True,
    },
    f"{device}:attr:StringAsCharsAttribute": {
        'type': 'char',
        'count': 128,
        'asyn': True,
    },
    f"{device}:attr:State": {
        'type': 'enum',
        'enums': [name for _, name in sorted(
            [(k, v.name) for k, v in tango.DevState.values.items()])],
        'asyn': True,
    },
    f"{device}:attr:Status": {
        'type': 'string',
        'asyn': True,
    },
    f"{device}:attr:DoubleSpectrum": {
        'type': 'float',
        'asyn': True,
    },
]
```

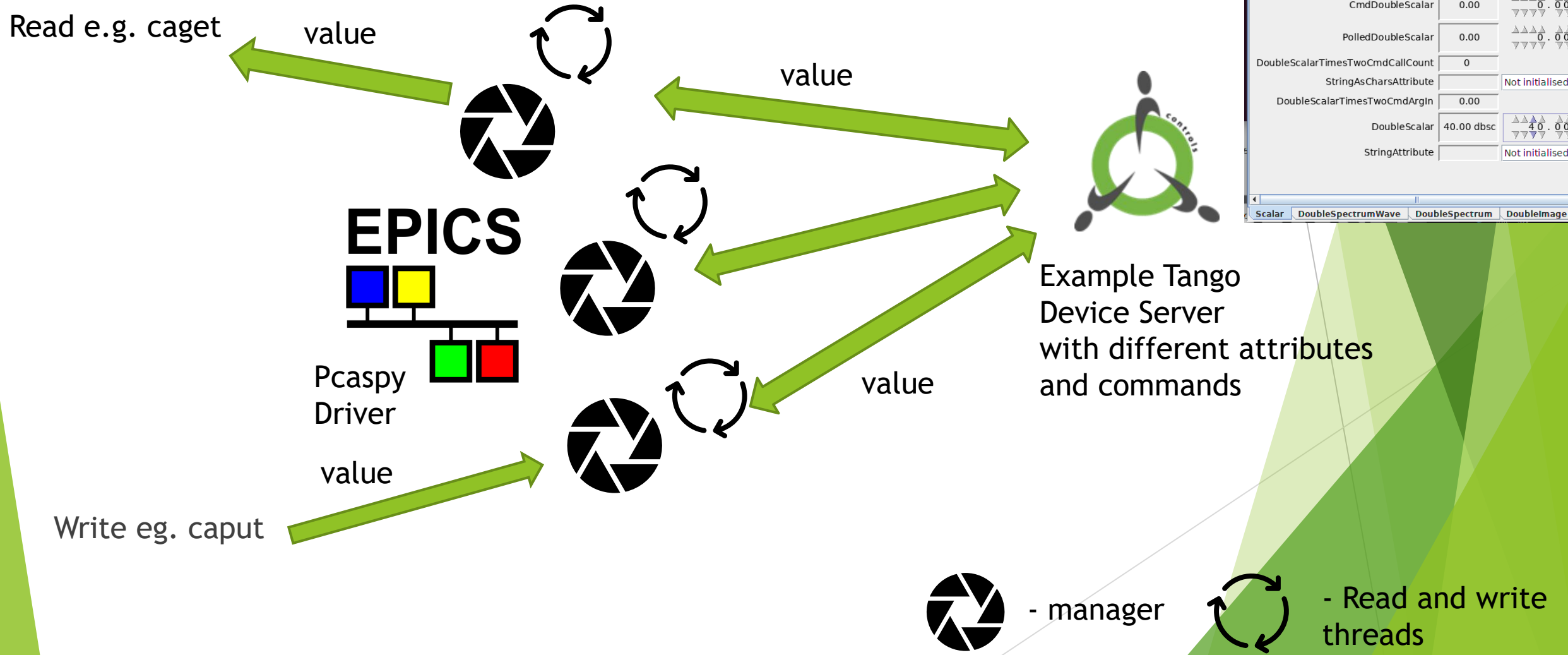
Corresponding pvdb file



Example Tango device

```
$ caget -c
„tango:test/epics_tango_bridge/1:attr:DoubleScala
r” -> Return 40
```

Reading and writing more detailed



Main advantages

- ▶ Read and write support using Channel Access
- ▶ Support for scalar attributes (normal and polled)
- ▶ Support for commands
- ▶ Support for spectrum (one dimensional array), and images (two dimensional array)
- ▶ Mapping alarms between Tango and EPICS

```
tango-cs@tangobox: ~/epics-tango-bridge/tests/integration/server
File Edit View Search Terminal Tabs Help
tango-cs@tan... x tango-cs@tan... x tango-cs@tan... x tango-cs@tan... x tango-cs@tan... x tango-cs@tan... x
tango-cs@tangobox:~/epics-tango-bridge/tests/integration/server$ camonitor "tango:test/epics_tango_bridge/1:attr:DoubleScalar"
tango:test/epics_tango_bridge/1:attr:DoubleScalar 2022-09-20 19:42:25.698149 -10 PolledDoubleScalar
tango:test/epics_tango_bridge/1:attr:DoubleScalar 2022-09-20 19:42:29.711061 20
tango:test/epics_tango_bridge/1:attr:DoubleScalar 2022-09-20 19:42:30.713339 30 DoubleScalarTimesTwoCmdCallCount
tango:test/epics_tango_bridge/1:attr:DoubleScalar 2022-09-20 19:42:31.718495 60 StringAsCharsAttribute
tango:test/epics_tango_bridge/1:attr:DoubleScalar 2022-09-20 19:42:32.734000 90
tango:test/epics_tango_bridge/1:attr:DoubleScalar 2022-09-20 19:42:33.736316 130 HIGH MINOR DoubleScalarTimesTwoCmdArgIn
tango:test/epics_tango_bridge/1:attr:DoubleScalar 2022-09-20 19:42:34.739384 150 HIGH MINOR
tango:test/epics_tango_bridge/1:attr:DoubleScalar 2022-09-20 19:42:35.742534 140 HIGH MINOR DoubleScalar
tango:test/epics_tango_bridge/1:attr:DoubleScalar 2022-09-20 19:42:36.746240 120 HIGH MINOR
tango:test/epics_tango_bridge/1:attr:DoubleScalar 2022-09-20 19:42:37.748392 100 HIGH MINOR StringAttribute
tango:test/epics_tango_bridge/1:attr:DoubleScalar 2022-09-20 19:42:38.750169 80
tango:test/epics_tango_bridge/1:attr:DoubleScalar 2022-09-20 19:42:39.752791 70 Scalar DoubleSpectrumWave Double
tango:test/epics_tango_bridge/1:attr:DoubleScalar 2022-09-20 19:42:40.766461 60
```

IC@MS

What is IC@MS?

Web application to manage alarms

- ▶ Integrated
- ▶ Cloud-ready
- ▶ Alarm Management System

Aim: increase effectivity during working with unexpected situations



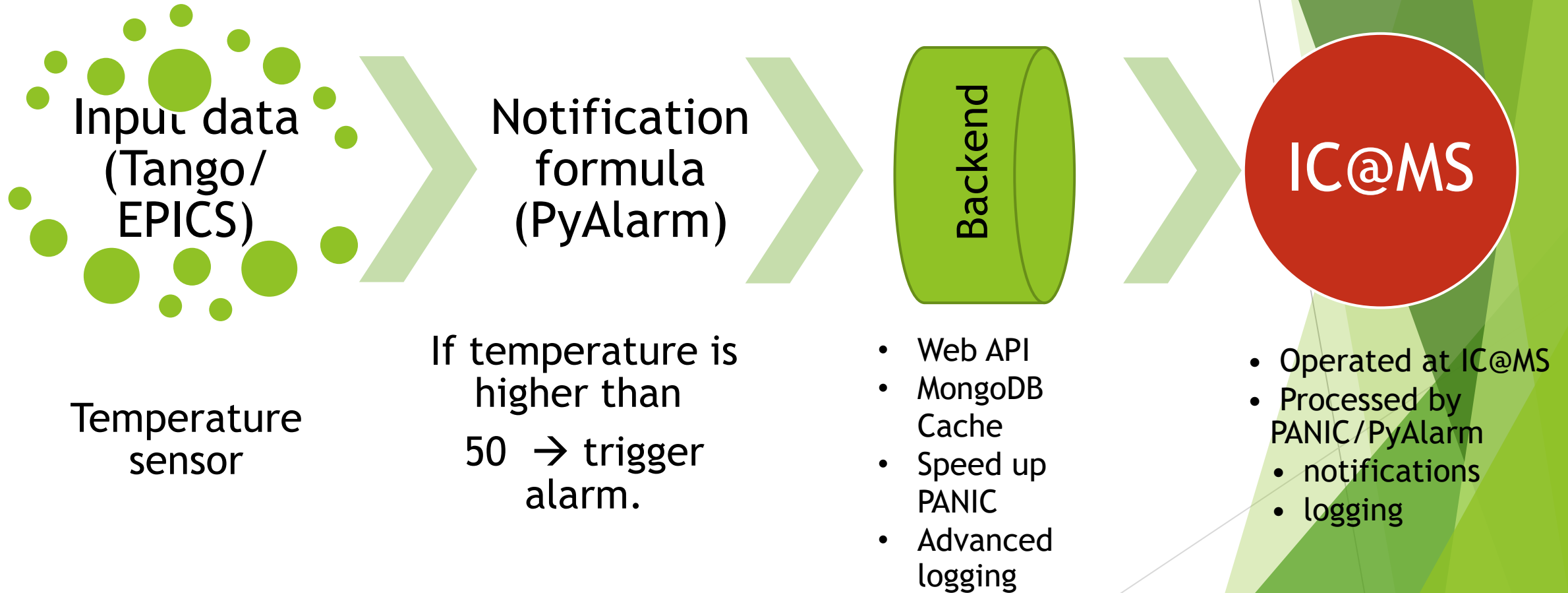
IC@MS based on PANIC - Alarm System developed in ALBA Synchotron (Barcelona)

<https://panic-training-materials.readthedocs.io/>

IC@MS is focused on daily operation



How does it work?



Why IC@MS?

1. Better user interface for everyday use.
2. Access from anywhere through web browser.
3. No need to install on the client's computer.
4. Web API.
5. Multiple access roles.
6. Integration with Active Directory, AD.
7. SMS, mobile or mail notifications.
8. Effective - tested with thousands of alarms.

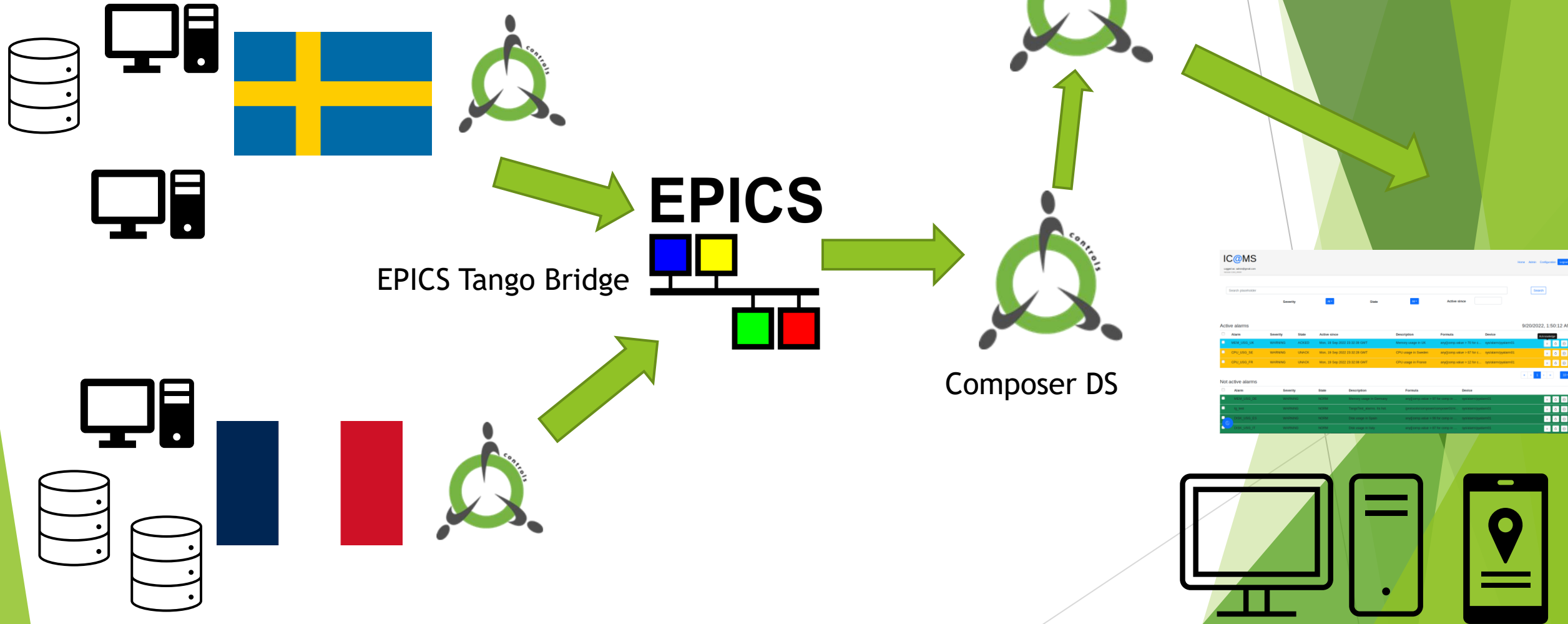
Main features

1. Alarms list
2. Modification of existing alarms
3. Multiple sources of data: EPICS PV, HTTP, MQTT, ...
4. New alarm definition
5. Alarms history browser
6. Multiple searching and filtering options
7. Documented web API (Swagger)



Time for DEMO 😊

Scenario



IC@MS

Search placeholder

Security [x] Size [x] Active since []

Active alarms 9/20/2022, 1:50:12 AM

| Alarm | Severity | State | Active since | Description | Priority | Device |
|-------------|----------|-------|-------------------------------|-----------------------|-----------------------|-----------------------|
| CPUS_CPU_26 | WARNING | OK | Mon, 19 Sep 2022 12:38:58 GMT | HighTemperature in OK | HighTemperature in OK | HighTemperature in OK |
| CPUS_CPU_26 | WARNING | OK | Mon, 19 Sep 2022 12:38:58 GMT | CPU usage in Warning | CPU usage in Warning | CPU usage in Warning |
| CPUS_CPU_26 | WARNING | OK | Mon, 19 Sep 2022 12:38:58 GMT | CPU usage in Error | CPU usage in Error | CPU usage in Error |

Not active alarms

| Alarm | Severity | State | Description | Priority | Device |
|-------------|----------|-------|-----------------------|-----------------------|-----------------------|
| CPUS_CPU_26 | WARNING | OK | HighTemperature in OK | HighTemperature in OK | HighTemperature in OK |
| CPUS_CPU_26 | WARNING | OK | CPU usage in Warning | CPU usage in Warning | CPU usage in Warning |
| CPUS_CPU_26 | WARNING | OK | CPU usage in Error | CPU usage in Error | CPU usage in Error |

Log in

IC@MS

MAX IV Login

Sign In

Email

admin@gmail.com

Password

••••••••

Log in!

[Forgot password?](#)

Alarms list - all in one place

IC@MS

Logged as: admin@gmail.com
Version: 0.9.0_#####

Home Admin Configuration Logout

Severity State Active since

Active alarms 9/20/2022, 2:00:32 AM

| <input type="checkbox"/> | Alarm | Severity | State | Active since | Description | Formula | Device | <input type="button" value="Acknowledge"/> |
|-------------------------------------|------------|----------|-------|-------------------------------|---------------------|-------------------------------|---------------------|---|
| <input checked="" type="checkbox"/> | MEM_USG_UK | WARNING | ACKED | Mon, 19 Sep 2022 23:32:39 GMT | Memory usage in UK | any([comp.value > 70 for c... | sys/alarm/pyalarm01 | <input type="button" value=" "/> <input type="button" value="↺"/> <input type="button" value="⊖"/> |
| <input type="checkbox"/> | CPU_USG_SE | WARNING | UNACK | Mon, 19 Sep 2022 23:32:28 GMT | CPU usage in Sweden | any([comp.value > 67 for c... | sys/alarm/pyalarm01 | <input type="button" value=" "/> <input type="button" value="↺"/> <input type="button" value="⊖"/> |
| <input type="checkbox"/> | CPU_USG_FR | WARNING | UNACK | Mon, 19 Sep 2022 23:32:08 GMT | CPU usage in France | any([comp.value > 12 for c... | sys/alarm/pyalarm01 | <input type="button" value=" "/> <input type="button" value="↺"/> <input type="button" value="⊖"/> |

Not active alarms

| <input type="checkbox"/> | Alarm | Severity | State | Description | Formula | Device | <input type="button" value=" "/> <input type="button" value="↺"/> <input type="button" value="⊖"/> |
|--------------------------|-------------|----------|-------|----------------------------|--------------------------------------|---------------------|---|
| <input type="checkbox"/> | MEM_USG_DE | WARNING | NORM | Memory usage in Germany | any([comp.value > 97 for comp in ... | sys/alarm/pyalarm01 | <input type="button" value=" "/> <input type="button" value="↺"/> <input type="button" value="⊖"/> |
| <input type="checkbox"/> | tg_test | WARNING | NORM | TangoTest_alarms. Its hot. | (protocols/composer/composer01/H... | sys/alarm/pyalarm01 | <input type="button" value=" "/> <input type="button" value="↺"/> <input type="button" value="⊖"/> |
| <input type="checkbox"/> | DISK_USG_ES | WARNING | NORM | Disk usage in Spain | any([comp.value > 99 for comp in ... | sys/alarm/pyalarm01 | <input type="button" value=" "/> <input type="button" value="↺"/> <input type="button" value="⊖"/> |
| <input type="checkbox"/> | DISK_USG_IT | WARNING | NORM | Disk usage in Italy | any([comp.value > 87 for comp in ... | sys/alarm/pyalarm01 | <input type="button" value=" "/> <input type="button" value="↺"/> <input type="button" value="⊖"/> |

Modification of existing alarm

IC@MS

Logged as: admin@gmail.com
Version: 0.9.0_####

WARNING: tg_test

Description TangoTest_alarms. Its hot.
Device: sys/alarm/pyalarm01



Description

TangoTest_alarms. Its hot.

Receivers

icams-notify@s2innovation.com

Severity

WARNING

Formula

(protocols/composer/composer01
/HTTP_temp>10.0)




Save changes


Monitoring values of PVs using EPICS Tango Bridge

Datasources MQTT HTTP Modbus

Composers Composer

[+ Add composer](#)

| Composer name | Composer attributes | Composer Values | |
|--------------------------|---------------------|----------------------------|---|
| epics/composer/australia | Cpu_usage1 | 86 |    |
| | Cpu_usage2 | 38 | |
| | Cpu_usage3 | 91 | |
| | Disk_usage1 | 79 | |
| | Disk_usage2 | 80 | |
| | Disk_usage3 | 69 | |
| | Eventqueuelast | None | |
| | Eventqueuesize | None | |
| | Memory_usage1 | 9 | |
| | Memory_usage2 | 13 | |
| | Memory_usage3 | 54 | |
| | Memusage | 232668 | |
| | State | None | |
| | State | None | |
| | Status | The device is in ON state. | |



EPICS PV as a new data source

Composers [Composer](#)

[+ Add composer](#)

| | | |
|-----------------------|---|---|
| Composer name | <input type="text" value="epics/compsr/1"/> | ✓ |
| Constants | <input type="text"/> | ✓ |
| Choose datasource | <input type="text" value="EPICS"/> | ✓ |
| Attribute name | <input type="text" value="temperature"/> | ✓ |
| Choose attribute type | <input type="text"/> | |
| Pv_name | <input type="text" value="tango:station1/server/thermo1:attr:temperature"/> | |

[←](#) [Submit!](#)

Browsing history of one alarm..

- ▶ Feature - remember all values for aggregating alarms

The screenshot displays the IC@MS web interface. At the top left, the logo 'IC@MS' is shown with the text 'Logged as: admin@gmail.com' and 'Version: 0.9.0_####'. The top right navigation bar includes links for 'Home', 'Admin', 'Configuration', and a 'Logout' button.

The main content area features a warning message: 'WARNING: CPU_USG_FR' with a description 'CPU usage in France' and device 'sys/alarm/pyalarm01'. Below this is a table of alarm events. The first row is highlighted in yellow and shows the date 'Mon, 19 Sep 2022 23:32:08 GMT' and the event 'CPU usage'. A 'Snap data' section below the table shows the date 'Mon, 19 Sep 2022 23:32:09 GMT' and the comment 'ALARM: CPU usage in France'. A pagination control at the bottom right shows '1' selected out of 5 items.

A 'Snap values' modal window is open in the center, displaying the following data:

| Attribute | Value |
|----------------------------------|-------|
| epics/composer/france/cpu_usage1 | 6 |
| epics/composer/france/cpu_usage2 | 54 |
| epics/composer/france/cpu_usage3 | 22 |

The modal window also includes a 'Close' button and a close icon (X) in the top right corner.

... and history of all alarms

IC@MS
Logged as: admin@gmail.com
Version: 0.9.0_#####

Home Admin Configuration **Logout**

Search placeholder

Search

Severity

All ▾

State

All ▾

Active since

History

| Alarm | Severity | Date/Time | Comment | Description | Device |
|--------------------|----------|-------------------------------|--------------------------------------|-------------------------------|---------------------|
| GERMANY_CPU_USAGE1 | ALARM | Mon, 19 Sep 2022 20:36:18 GMT | ALARM: Too high cpu usage in germany | Too high cpu usage in germany | sys/alarm/pyalarm01 |
| GERMANY_CPU_USAGE1 | ALARM | Mon, 19 Sep 2022 20:35:43 GMT | ACKNOWLEDGED: RESET | Too high cpu usage in germany | sys/alarm/pyalarm01 |
| GERMANY_CPU_USAGE1 | ALARM | Mon, 19 Sep 2022 20:35:17 GMT | | Too high cpu usage in germany | sys/alarm/pyalarm01 |
| GERMANY_CPU_USAGE1 | ALARM | Mon, 19 Sep 2022 20:35:01 GMT | ALARM: Too high cpu usage in germany | Too high cpu usage in germany | sys/alarm/pyalarm01 |
| GERMANY_CPU_USAGE1 | ALARM | Mon, 19 Sep 2022 20:35:00 GMT | RESET: reset alarm | Too high cpu usage in germany | sys/alarm/pyalarm01 |
| GERMANY_CPU_USAGE1 | ALARM | Mon, 19 Sep 2022 20:35:00 GMT | ACKNOWLEDGE: Ack alarm | Too high cpu usage in germany | sys/alarm/pyalarm01 |
| TEST_EPICS_AMPLI | ALARM | Sun, 18 Sep 2022 19:29:57 GMT | ACKNOWLEDGED: ACKNOWLEDGED | Test epics ampli alarm | sys/alarm/pyalarm01 |



Thank you!

<https://s2innovation.com>

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