



PANIC 7

And the Evolution of Tango Alarm Handlers

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- PANIC Architecture
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- The IEC62682 / ISA Standards: States
- Prevent Alarm Flooding
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- Convergence between Tango Alarm Systems
- Testing platform

What's an Alarm System?

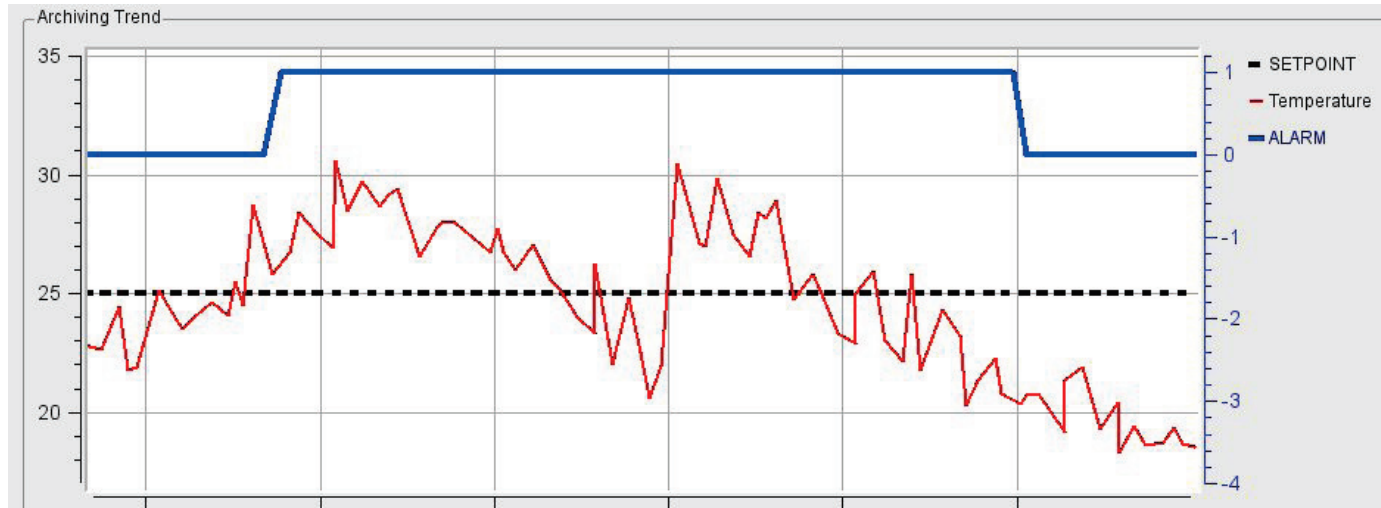
Following the **IEC 62682:2014** "*Management of Alarm Systems for the Process Industries*" Standard:

- The primary function of an Alarm System will be to notify abnormal process conditions or equipment malfunctions and support the operator response.
- The Alarm System is **NOT** part of the protection nor safety systems, Safety must have separate tools following its own regulation.
- The Alarm System is part of Operator Response, thus it's part of the **HMI** (including the non-graphical part of it).

What's an Alarm?



T1_ALARM = my/plc/01/Temperature > SETPOINT

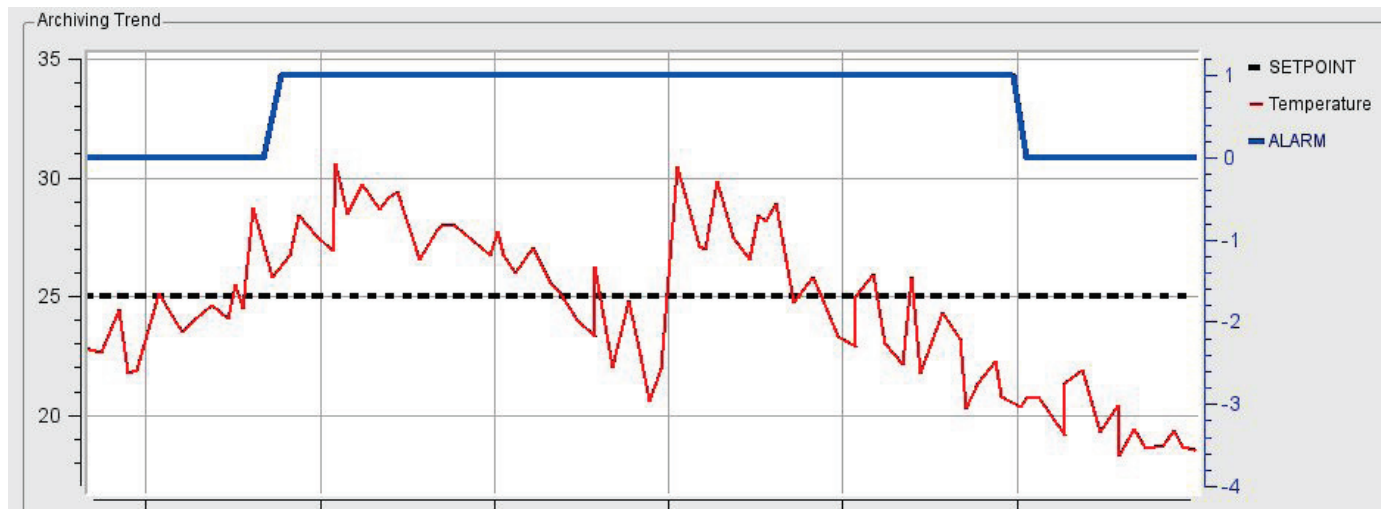


What's an Alarm?

T1_ALARM = my/plc/01/Temperature > SETPOINT

T2_ALARM = my/plc/02/Temperature.ALARM

TG_ALARM = T1_ALARM OR T2_ALARM



What's an Alarm?

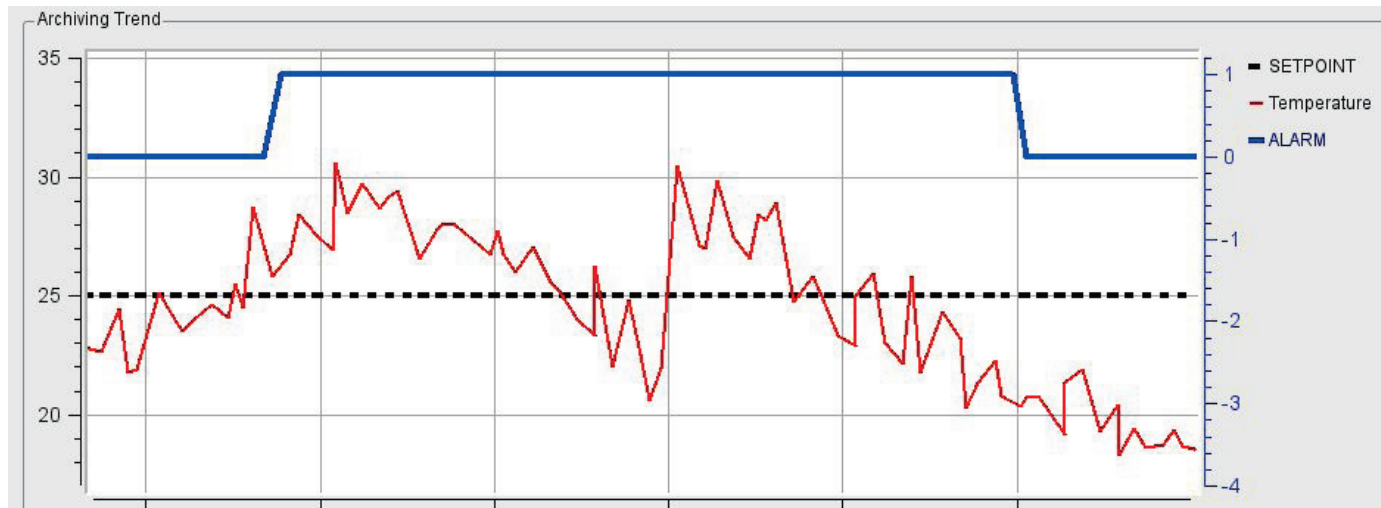


T1_ALARM = my/plc/01/Temperature > SETPOINT

T2_ALARM = my/plc/02/Temperature.ALARM

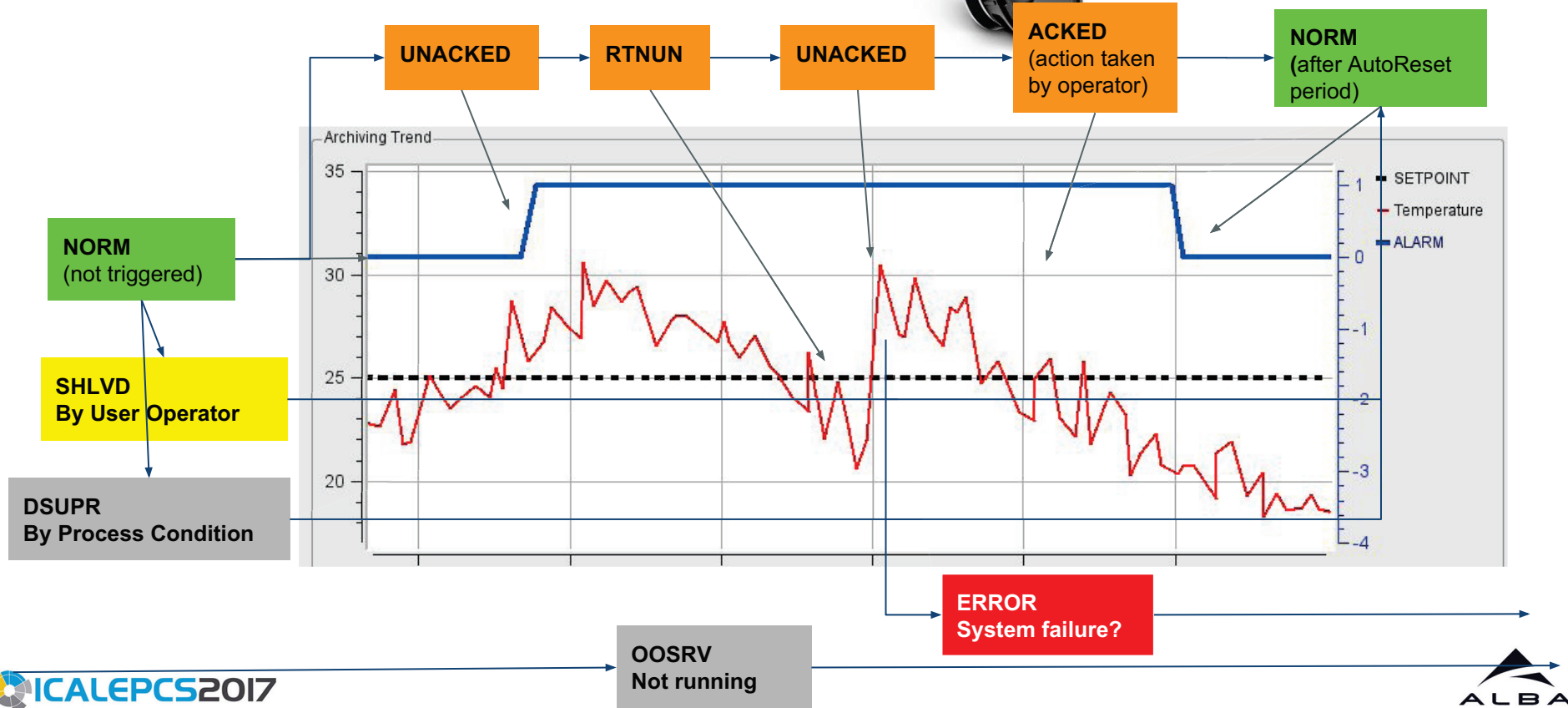
TG_ALARM = T1_ALARM OR T2_ALARM

TS_ALARM = **any**(t>SETPOINT for t in **FIND**(*/plc/*/Temperature))

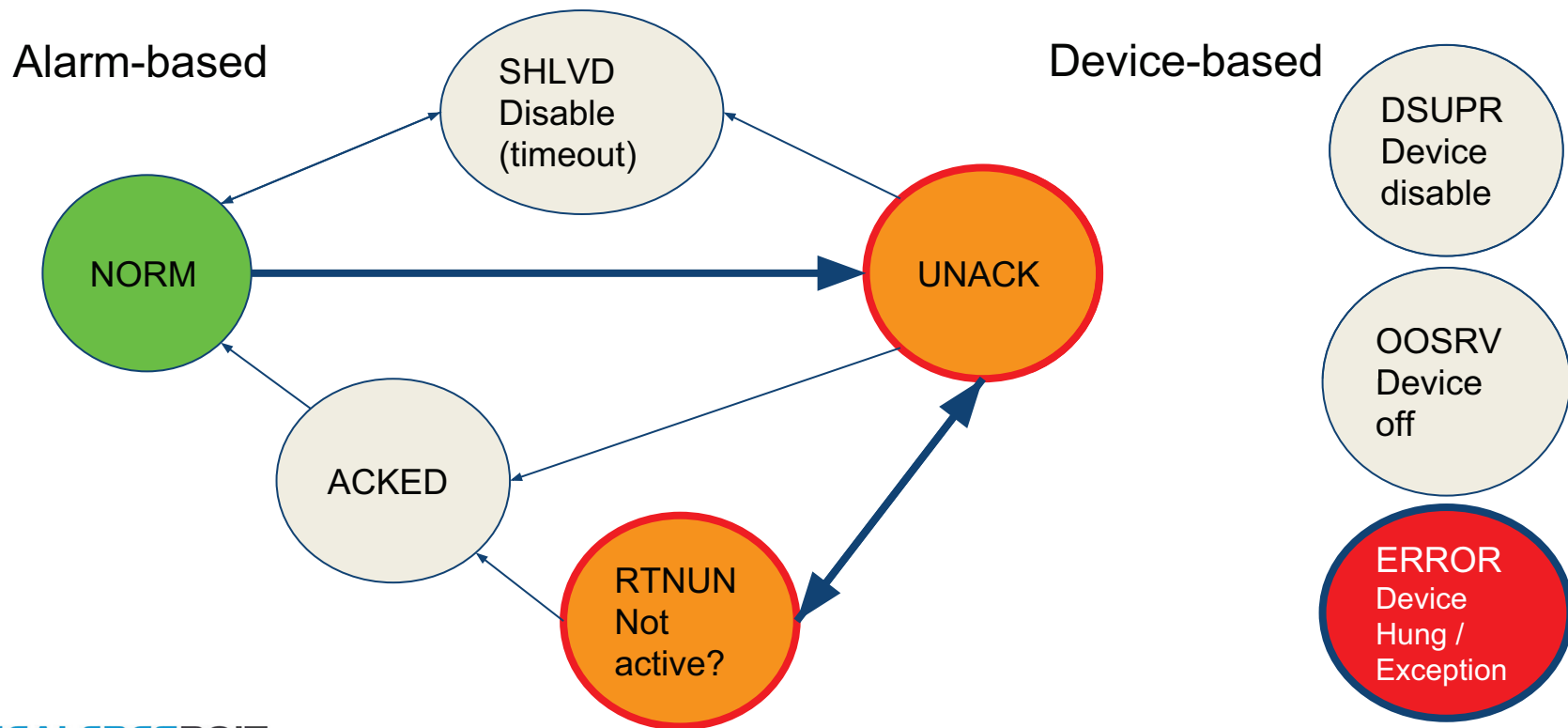


Panic alarms support Tango attributes introspection, regular expressions and any python built-in

Alarm States (IEC62682)



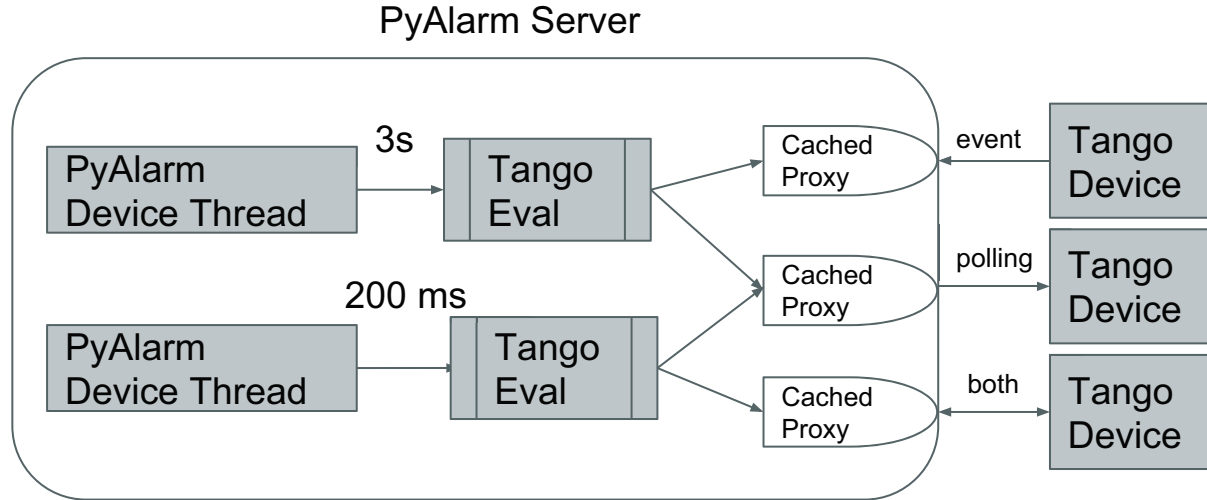
IEC 62682: Alarm States



PyAlarm Tango Device



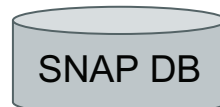
Each device evaluates its alarm *formulas* at its own frequency ($\geq 10\text{Hz}$)



Alarm formulas are exported as *attributes* , and its changes are *annunciated*
So, each PyAlarm is an AlarmSystem on its own!



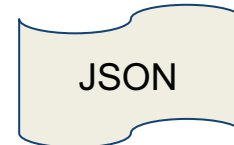
Tango
Attribute



SNAP DB

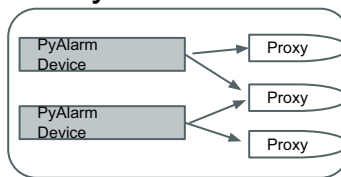
Email
JIRA

Remote Logs (LoggerDS / FolderDS)



JSON

PyAlarm Server



FEXX/VC/VALVE/Open()

Tango Commands

tbl:10000/SR/ID/MOTOR/move(0.)

Several Annunciators (aka Receivers) can be triggered at each alarm activation or reset.

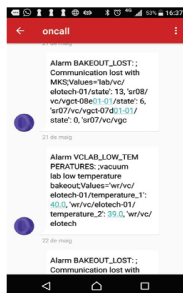


Audio (FestivalDS)

SMS / Telegram



Details
18 May 17 11:07 AM
Description
TAG_DW_POT_POT_B_STATUS_WARNING
ALARM at 2017-05-18 11:07:01
Alarm active since 2017-05-18 11:07:01
Alarm device BUILDINGCTSQLSERVER-DIV
Description: DW_POT_POT_B_STATUS goes OFF a las bombas POTB cambian su estado a OFF.
Severity: WARNING
Format: BUILDINGCTSQLSERVER/UP and BUILDINGCTSQLSERVER
DW_POT_POT_B_STATUS-2
View on JIRA
buildingctsqlserver_pot_pot_b_status: 1.0
buildingctsqlserver_up: 1



Panic architecture

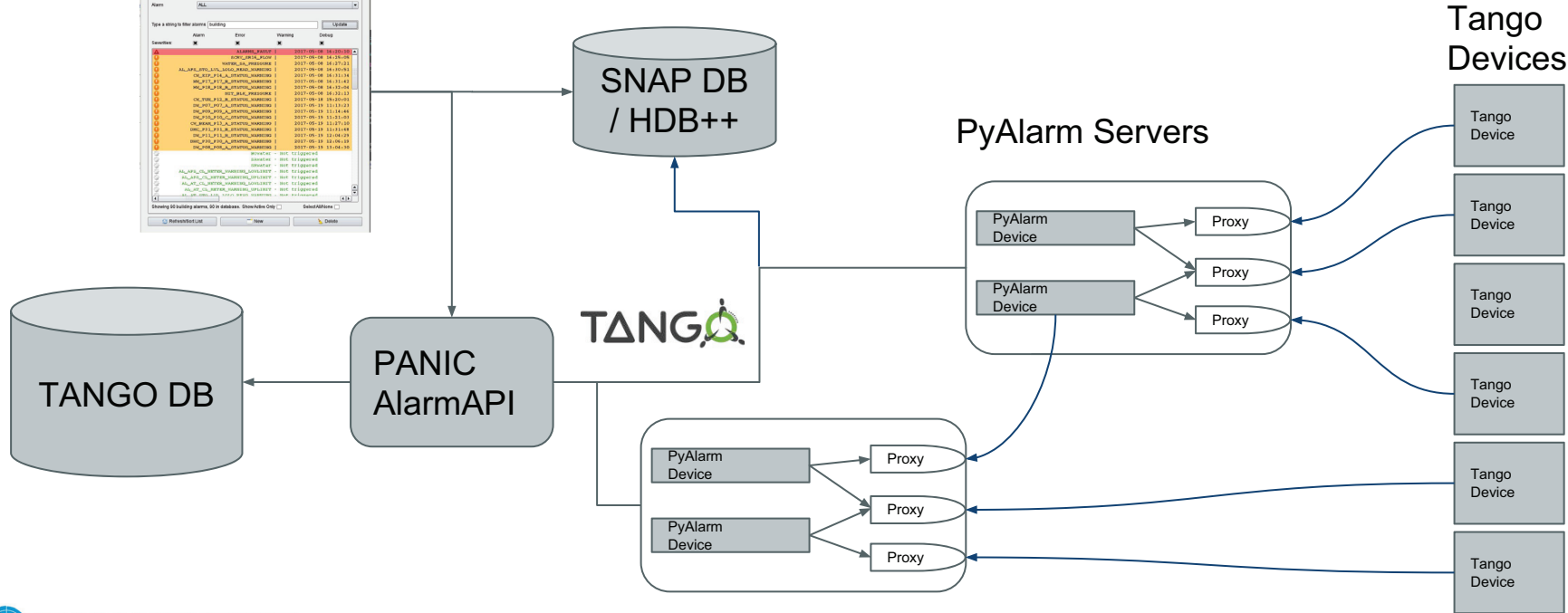
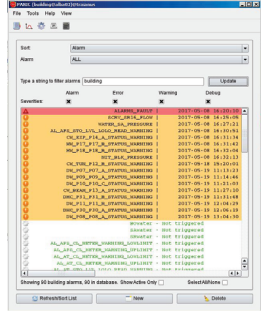
Alarms are grouped in autonomous PyAlarm servers.



AlarmAPI provides a unified view.

Tango DB and Archiving are used for config and logging.

AlarmGUI



Alarm GUI

Create
Modify
Preview
Sort (state,
priority and time)
Configure
Filter
Report
...

PANIC 6.4.0 (*/*/*[~*(building|bake)*]@alba03) (on ctdevelsa)

File Tools Help View

Sort: State

State

Filter:

Update Save As

ShowActive Only ☐ SelectAll/None ☐

LT_DI_SCO01_LOST	-	UNACK	-	2017-09-26 09:13:44	-	m	See Alarm Details
RADIATION_WARNING	-	UNACK	-	2017-09-26 09:57:10	-	m	Preview Formula/Values
LT_DI_SCO01_FAULT	-	UNACK	-	2017-09-26 09:13:42	-	m	View History
BO_VC	-	UNACK	-	2017-09-26 09:13:24	-	m	Change Priority
LT_DI_SCO01_DISABLED	-	UNACK	-	2017-09-26 09:13:54	-	m	ResetAlarm(s)
TIMING_RHB	-	UNACK	-	2017-09-26 09:13:41	-	m	Acknowledge/Relounce Alarm(s)
TIMING_MASTER_ALARM	-	UNACK	-	2017-09-26 09:13:35	-	m	Disable/Enable Alarm(s)
TIMING_HB	-	UNACK	-	2017-09-26 09:13:29	-	m	
EPS_CCG_VC_VALUES_DIFFER	-	UNACK	-	2017-09-26 09:13:21	-	m	
BEEP_TEST	-	UNACK	-	2017-07-25 15:05:52	-	m	
ARCHIVING02	-	ACKED	-	2017-09-26 09:13:39	-	m	
SCM_CryocoolerCoolerError	-	NORM	-	2017-09-26 11:36:53	-	m	
SCM_InterlockQuench	-	NORM	-	2017-09-26 11:36:53	-	m	
NIRAS_temp_updown	-	NORM	-	2017-09-26 11:36:53	-	m	
NIRAS_NirrorIII_MPSnotSafe	-	NORM	-	2017-09-26 11:36:53	-	m	
NIRAS_temp_warning_lastst	-	NORM	-	2017-09-26 11:36:53	-	m	
NIRAS_temp_warning	-	NORM	-	2017-09-26 11:36:53	-	m	
BadOrbit	-	NORM	-	2017-09-26 11:36:53	-	m	
BEAM_LOST	-	NORM	-	2017-09-26 11:36:53	-	m	



Alarm GUI

Create
Modify
Preview
Sort
Ack / Reset
Configure
Filter
Report
Export
...

PyAlarm Device Configuration

Attribute Name	Attribute Value
1 AlarmThreshold	3
2 AlertOnRecovery	no
3 AutoReset	3600
4 CreateNewContexts	False
5 Enabled	120
6 EvalTimeout	500
7 FlagFile	/tmp/alarm_ds.nagios
8 FromAddress	oncall
9 HtmlFolder	htmlreports
10 IgnoreExceptions	True
11 LogFile	/tmp/alarm_bl09_MISTRAL-CT-Alarms.log
12 LogLevel	INFO
13 MaxMessagesPerAlarm	20
14 PollingPeriod	5
15 Reminder	0
16 RethrowAttribute	False
17 RethrowState	True
18 SMSConfig	controls@cells:cells
19 StartupDelay	0
20 UseProcess	False

Refresh

ALARM: SR01_VACUUM <@gordianus>

Name: SR01_VACUUM

Status: OK [Last Report] [Reset]

Disabled: ☐

Acknowledged: ☐

Device: sr01/ct/alarms

Severity: ALARM

Description: Check vacuum devices in SR01

Receivers: vacuum@cells.es

Formula:

```
SR01VC(ALL/MaxPressure > 1e-8
or any(is not in (ON,MOVING)
for s in FIND(SR01?mpct?state))
or any(is in (UNKNOWN,FAULT)
for s in FIND(SR01?mpsp?state))
or any(is in (OFF,FAULT,UNKNOWN))
```

Result:

[Edit] [Preview] [Save] [Cancel]

Alarm History Viewer <@gordianus>

Date	Alarm	Comment
017-06-05 10:39:56	BUILDING_ALARMS	ALARM: Building alarms not running
017-06-05 10:39:49	ALBA03_CPU	ALARM: alba03 usage is high
017-06-05 10:02:29	PSS_TOPUP_NOT_ALL	RECOVERED
017-06-05 07:43:00	BEAM_LOST	ALARM: Beam current lost.
017-06-05 07:42:02	FOFB_STOP	ALARM: Fast Orbit Feedback Stopped
017-06-05 07:41:10	PSS_TOPUP_NOT_ALL	ALARM: PSS Does not allow TopUp.
2017-06-04 20:47:22	BO_PC	ALARM: Problem in booster power supplies
2017-06-04 20:05:13	BO_PC	ALARM: Problem in booster power supplies
2017-06-04 09:41:34	DW_P11_P11_A_STATUS_WARNING	ALARM: DW.P11.P11_A_VAL STATUS goes OFF si las bombas P11A

ALBA Intranet

Water leak detector alarm

Created by Mayra Martin, last modified by Juan Carlos Graldo González on May 22, 2017

This procedure describes what to do in case of a Water leak detector alarm

Introduction

- At ALBA we have a water leak detection system installed at critical places where there are water cooled equipment. This system detects water falling to the floor.
- The water leak detector consists of a tape with three parallel metal wires placed at floor, this tape is connected to an electronic sensing device, and this device is connected to the ALBA EPS. The three metal wires on the tape have no electrical contact between them, and when some water gets in touch with the tape, it produces the electrical contact between wires, electronic device detects it and sends a signal to EPS.



IEC 626862: Alarm Flooding



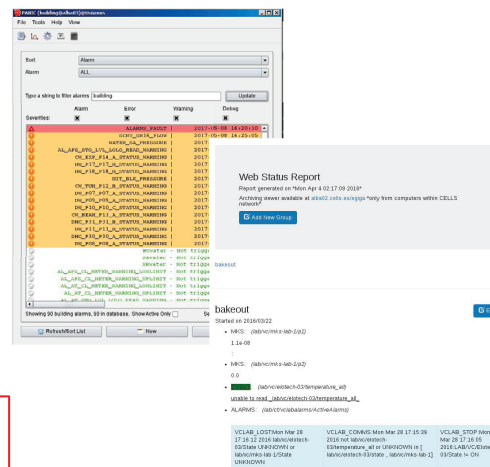
Table 2: KPI's[4]EEMUA

<u>KPI</u>	Acceptable value	Flood
Alarms/Day	12*24*operator	
Alarms/Hour	12/operator [UM]	≥ 60
Alarms/10mins	2/operator	≥ 10
Alarm Peaks (N hours with N>30)	(<1%)	
(floods) 10mins with >10	(<1%)	
TOP 10 recurring alarms	(<5% of total)	
Chattering alarms	0	
Stale alarms/day	< 5	
Priority proportion	80,15,5,1 80% of alarms should not require immediate action	
Unauthorized alarm change	0	

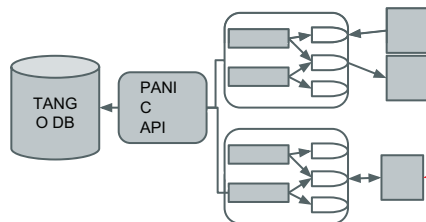
Alarm Views



New API, multi-database, user-view centered, for qt, web, ...



PANIC on tango_host_1:10000

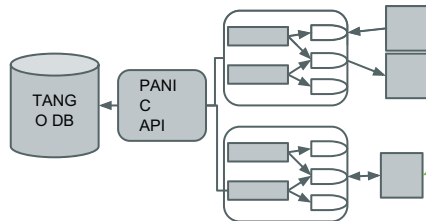


Vacuum
AlarmView

Cooling
AlarmView

BLXX
AlarmView

PANIC on tango_host_2:10000



TANGO on tango_host_1:10000



TANGO C++
Alarm System

Save as UserFilter / AlarmView / Custom panel

PANIC 6.4.0 (*/*/*[~*(building)bake*]@alba03) (on ctdevelsa)

File Tools Help View

Sort: User filters
UserFilters: eps|pss|plc
Filter:
Update Save As

ShowActive Only ☐ SelectAll/None

Icon	Alarm Name	Status	Time	Source	Description
⚠	RADIATION_WARNING	UNACK	2017-09-26 09:57:10	sr/pss/alarms	Radiation level warning
⚠	RF_PSM_MODULE_DEFECTIVE	UNACK	2017-09-26 09:14:09	sr/rf/alarms	There is a problem with the RF module
⚠	EPS_COG_VC_VALUES_DIFFER	UNACK	2017-09-26 09:13:21	sr/eps/alarms	There is a problem with the EPS module
⚠	LI_WATER_LEAK	NORM	2017-09-26 11:36:53	sr/eps/alarms	There is a problem with the LI module
⚠	MIRAS_temp_updown	NORM	2017-09-26 11:36:53	sr/eps/alarms	There is a problem with the MIRAS module
⚠	MIRAS_MirrorIN_MPSnotSafe	NORM	2017-09-26 11:36:53	sr/eps/alarms	There is a problem with the MIRAS module
⚠	MIRAS_temp_warning_last	NORM	2017-09-26 11:36:53	sr/eps/alarms	There is a problem with the MIRAS module
⚠	MIRAS_temp_warning	NORM	2017-09-26 11:36:53	sr/eps/alarms	There is a problem with the MIRAS module
⚠	PSS_TOPUP_NOT_ALL	NORM	2017-09-26 11:36:53	sr/pss/alarms	There is a problem with the PSS module
⚠	PULSED	NORM	2017-09-26 11:36:53	sr/pss/alarms	There is a problem with the PSS module
⚠	PSS_RAD_ALARM_SLOPE	NORM	2017-09-26 11:36:53	sr/pss/alarms	There is a problem with the PSS module
⚠	LifeTime	NORM	2017-09-26 11:36:53	sr/pss/alarms	There is a problem with the PSS module
⚠	SR11_EPS_INTERLOCK	NORM	2017-09-26 11:36:53	sr/eps/alarms	There is a problem with the SR module
⚠	SR12_EPS_INTERLOCK	NORM	2017-09-26 11:36:53	sr/eps/alarms	There is a problem with the SR module
⚠	ANY_EPS_SR_VC	NORM	2017-09-26 11:36:53	sr/eps/alarms	There is a problem with the SR module
⚠	SR13_EPS_INTERLOCK	NORM	2017-09-26 11:36:53	sr/eps/alarms	There is a problem with the SR module
⚠	SR14_EPS_INTERLOCK	NORM	2017-09-26 11:36:53	sr/eps/alarms	There is a problem with the SR module

PANIC Alarm Panel (*): 2017-09-14 09:56:38 (on controls02)

See Alarm Details
Preview Formula/Values
View History
Change Severity
Reset Alarm(s)
Acknowledge/Resonance Alarm(s)
Disable/Enable Alarm(s)

BL29_STATES
BL29_PRIMARY_WATER_SH
BL29_PRESSURE_P2
BL29_PRESSURE_4
BL29_PRESSURE_4
BL29_PRESSURE_3
BL29_PRESSURE_3
BL29_PRESSURE_1
BL29_MONO_PATM_PRESSURE_INTERLOCK
BL29_IPCT_SWITCH_TO_OFF
BL29_IPCT_OFF
BL29_EPS_WARNING
BL29_BK_COMMS_LOST
BL29 refill
BL29_PRESSURE_HYDROT
BL29_MONO_PATM_PRESSURE_WARNING
BL29_BK PRESSURE
BL29_BK_ELOTECH TEMPERATURES
BL29_BK START
PANIC

LT_DI SCO01 LOST	compensationPS	Water_Cooling Problem	WaterLeakDetectors	FI FILL	SRwater	SR thermocouple	SR VC	SR PC	SR_KB2 stay
SR_CURRENT LIMIT	SR BPMs	SR02_EPS MT_DELTA Y	SCW InterlockQuench	SCW CryocoolerCoolerError	SAwater	SRfrequency	RF_SR 14B	RF_SR 14A	RF_SR 10B
RF_SR 10A	RF_SR 08B	RF_BO 82A	RF 14A water	RADIATION WARNING	PULSED	PSS_RAD ALARM SLOPE	MIRAS_temp warning tests	MIRAS_temp warning	MIRAS_temp updown
MIRAS_MirrorHV MPSnotSafe	LIwTime	LT VC	LT PC	LT_DI SCO01 FAULT	LI_VACUUM OK	LI_PULSE K2_ST	LI_PULSE K1_ST	LI_MAGNETS ITLK	LI K2
LI K1	LI EGUN	LI_ALARM_TEMPERATURE BUNKER	LI_ALARM SPS	FEW ABSORBERS	FE VC	Excitation on	Ssd_BOtoSR Efficiency	BadOrbit	BT VC
BT PC	BT OFF	BOwater	BO VC	BO_RF RAMP_SLOPE	BO PC	BEAM LOST	ARCHIVING02	ANY	BT
UV_Det KAZ_FailV	UV_Det KAZ_FailR	TIMING RHB	TIMING MASTER ALARM	TIMING HB	TIMING EVG	SDPB STOP	RF_SR BO_COIL FAIL		
RF_SR 10B_COIL FAIL	RF_SR 10A_COIL FAIL	RF_SR 08B_COIL FAIL	RF_SR 08A_COIL FAIL	RF_SR 06A	RF_RESET CTMPS	RF CPUS	RF 10B IGT Reflected		
PSS_RAD NONE	PSS_RAD CONTROL UPDATED	PSS_RAD ARCHIVE UPDATED	PSS_RAD ALARM TRLOW	PSS_RAD ALARM_TRHIGH	Master CoolWater problem	LT_DI_SCO01 DISABLED	LI_TDS NOT OK	LI COOLING PWR	LI ALARM MESSAGE
INJECTION READY	INJECTION NOTICE	FOFB STOP	EPS_CCG VC_VALUES DIFFER	NO RF ON	BEEP FAIL	ALBA03 CPU	06A cond stopped	BEEP TEST	PANIC

- See Alarm Details
- Preview Formula/Values
- View History
- Change Priority
- Reset Alarm(s)
- Acknowledge/Renounce Alarm(s)
- Disable/Enable Alarm(s)

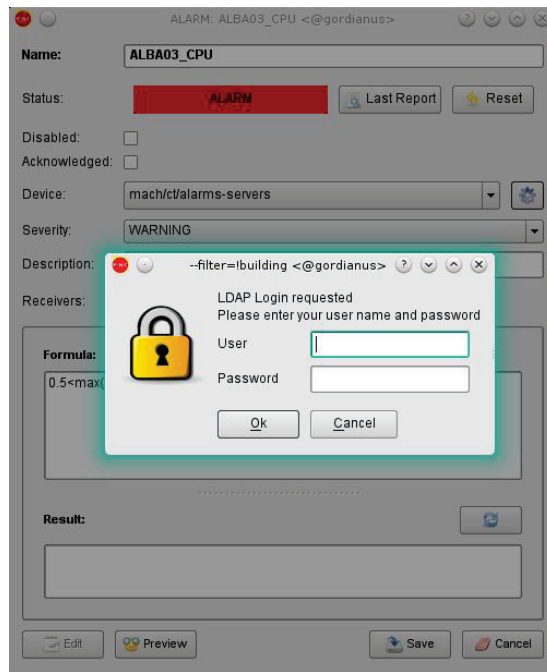
User authentication

We validate and log each change in PANIC using **LDAP** user authentication.

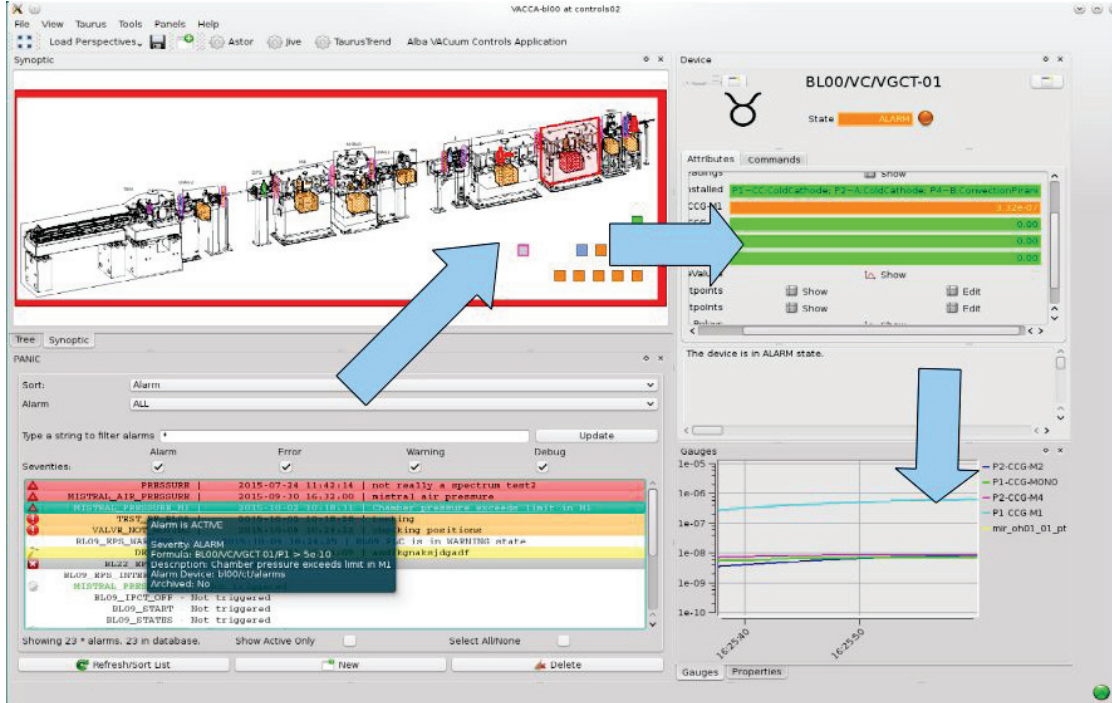
An alternative using database-stored hashes is also available as local solution.

The list of allowed users will depend on each alarm (and a few admins have access to all).

Add **TangoAccessControl** to the loop!



Interaction with Taurus Synoptics



github.com/tango-controls/vacca
taurus-scada.org

Alarm Systems in Tango



	Name	Language	Devices	Architecture	Features
Soleil	Alarm Archiving Database	Java	Archiver Extractor Manager	Centralized	Quality check Log Database
Elettra	Tango Alarm System	C++	Tango Alarm Handler	Distributed devices, centralized log	Formulas Events Speed on/off annunciators Groups Log Database
ALBA	PANIC	Python	PyAlarm	Distributed	Formulas Events* Regexp Multiple annunciators Logs are External Filtering

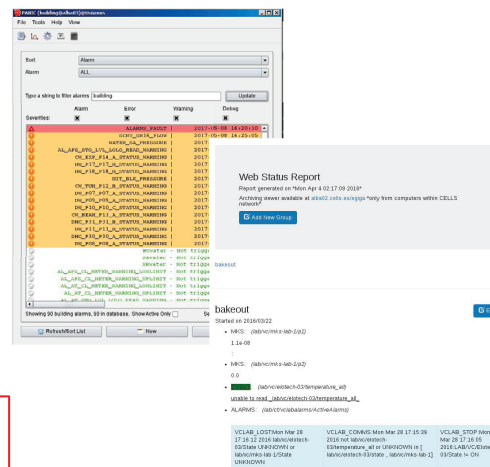
Convergence with Elettra's Alarm System (HMI compatible)

Concept	AlarmHandler	PANIC	Integration
Database	Its own mysql database or Alarm attributes	Free/Device/Attribute Tango DB properties or csv files	Attribute properties in Tango DB
Alarm attributes	name, formula, level, group, message	Tag, formula, severity, description	Tag, formula, priority, message
Classification	Grouped using alarm group attribute	Group by class/device/view	Support both
Annunciators	on_command, off_command	receivers	Annunciators on all state transitions
Priorities	Level	Severity	Priority
Tango attributes to HMI	Enum: NORM, UNACK, ACKED, RTNUN, SHLVD, DSUPR, OOSRV	Boolean	Enum values with NORM=0 and positive values for condition active
Summaries	1alarm + one string array for each alarm state	One attribute alarm + one array for each alarm state	A single array attribute with all alarm information codified in JSON format

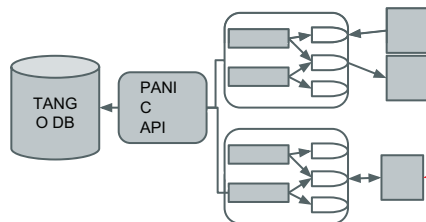
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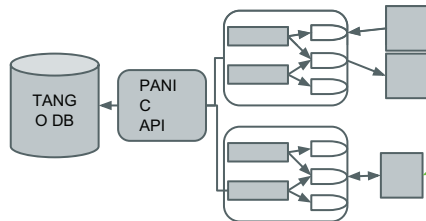
PANIC on tango_host_1:10000



Vacuum
AlarmView

Cooling
AlarmView

PANIC on tango_host_2:10000



BLXX
AlarmView

TANGO on tango_host_1:10000



TANGO C++
Alarm System

10 YEARS IN PANIC!!



ALBA : Starting 2006, 657 alarms in Accelerators and 8 Beamlines, monitoring 2506 attributes.

MAX IV : 10067 alarms in Accelerators Control System

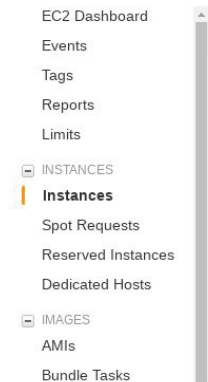
SKA(future) : ~**1e5** alarms in ~**2K5** hosts!

Solaris? ESRF? Elettra? Somebody else?



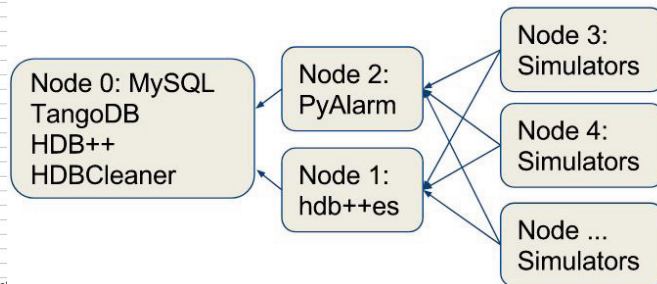
Testing PANIC

Simulators, test case especifications, scale tests, see TUDPL01 this afternoon ...



Launch Instance	Connect	Actions
Filter by tags and attributes or search		
Name		
tango-chaos-0		
tango-chaos-1		
tango-chaos-2		
tango-chaos-3		
tango-chaos-4		
tango-test		

PyAlarm/Clock	PyAlarm	test/panic/ck02	AlarmList	CK02: False and not CK02
			AlarmSeverities	CK02: DEBUG
		test/panic/ck05	AlarmList	CK05: False and not CK05
			AlarmSeverities	CK05: DEBUG
		test/panic/ck1	AlarmList	CK1: not CK1
			AlarmSeverities	CK1: DEBUG
		test/panic/ck2	AlarmList	CK2: NOW()%2 < 1
			AlarmSeverities	CK2: DEBUG
		test/panic/ck5	AlarmList	CK5: NOW()%5 < 2.5
			AlarmSeverities	CK5: DEBUG
		test/panic/ck10	AlarmList	CK10: NOW()%10 < 5
			AlarmSeverities	CK10: DEBUG
			AlarmThreshold	
PyAlarm/Group	PyAlarm	test/panic/group	AlarmList	GROUP_0: GROUP(test/panic/ck*ck5)
				GROUP_1: GROUP(CK5, CK10)
				GROUP_OR: GROUP(CK5, CK10, x=1)
				GROUP_AND: test/panic/ck2/ck2 and test/panic/ck5/ck5
				GROUP_ALL: GROUP(GROUP_0, GROUP_1, GROUP_2, GROUP_AND)
			AlarmSeverities	GROUP_1: ALARM
				GROUP_OR: ALARM
				GROUP_AND: ALARM
				GROUP_ALL: ALARM
			AutoReset	0.0001
			PollingPeriod	0.5
			AlarmThreshold	1



Time for questions

Don't panic!



tango-controls.org/community/forum/
pythonhosted.org/panic
github.com/tango-controls/panic
github.com/tango-controls/fandango

fandango 

