IC@MS — WEB-BASED ALARM MANAGEMENT SYSTEM

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Abstract

The IT world is moving to the web and cloud. IC@MS is a web-based alarm management system. Every control system can face unexpected issues, which demand fast and precise reactions. As the control system starts to grow, it requires the involvement of more engineers to access the alarm list and focus on the most important ones. IC@MS allows the users to access the alarms fast, remotely via a web browser. According to current trends in IT, creating a web application turned out to be the most comfortable solution. IC@MS is the extension and web equivalent to the Panic GUI desktop application. There is no need to install it on the client's computer. The access to the different functionalities can be restricted to the users provided just with appropriate roles. The web-based alarm management system provides a better user-friendly user interface for everyday use with Integration with Active Directory. Alarms can be easily added, edited, and managed from the web browser*. It has a Web API that can be used by 3rd party applications. The instance of IC@MS is available on Amazon Web Services (AWS) and Microsoft Azure clouds.

ALARM SYSTEM IN TANGO

Tango Controls is a free open source device-oriented controls toolkit for controlling any kind of hardware or software and building SCADA (Supervisory Control And Data Acquisition) systems (Fig. 1). Tango Controls is operating system independent and supports C++, Java and Python for all the components. As Tango Controls exists for more than 20 years and becomes more and more popular among facilities, it has proved itself as a reliable toolkit [1]. Engineers at institutes like particle accelerators are daily dealing with hundreds or thousands of signals per second coming from different types of devices. Therefore, there is a need of an application to detect and monitor non typical situations. One of the most popular solution is PANIC and PyAlarm Device Server.
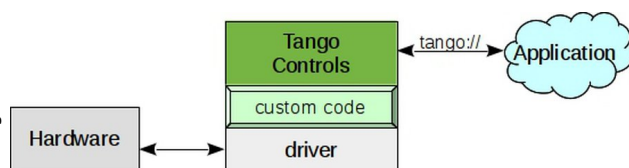

Figure 1: Tango high level overview.

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PANIC

PANIC (Package for Alarms and Notification of Incidences from Controls) is an alarm system developed in ALBA Synchrotron. It is a set of of tools that provides:

- Periodic evaluation of a set of conditions.
- Notification (email, sms, pop-up, speakers)
- Keep a log of what happened. (files, Tango Snapshots)
- Taking automated actions (Tango commands / attributes)
- Tools for configuration/visualization

The Panic package contains the python AlarmAPI for managing the PyAlarm device servers from a client application or a python shell. The panic module is used by PyAlarm, Panic Toolbar and Panic GUI [2].

PyAlarm

The key element of PANIC toolkit is PyAlarm device server. This device server is used as a alarm logger, it connects to the list of attributes provided and verifies its values [3]. That features are needed to ensure comfortable alarm management for user. Each alarm is independent in terms of formula and receivers, all alarms within the same PyAlarm device will share a common evaluation environment determined by PyAlarm properties.

Panic GUI

Panic GUI is a application written using Taurus library. It allows to check existing alarms and manipulate them. Panic GUI is an desktop application for controlling and managing alarms. It depends on panic and taurus libraries. It allows the user to visualize existing alarms and adding/editing/deleting alarms. In edit mode user can change name, move alarms to another device, change descriptions and modify formulas. Additional widgets in which the app is equipped allows alarm history viewing, phonebook editing and device settings manipulation.

EPICS

EPICS (Experimental Physics and Industrial Control System) is a set of Open Source software tools, libraries and applications developed collaboratively and used worldwide to create distributed soft real-time control systems for scientific instruments such as a particle accelerators, telescopes and other large scientific experiments. Moreover, it is a set of software tools and applications which provide a software infrastructure for use in building distributed control systems (Fig. 2). Such distributed control systems typically comprise tens or even hundreds of computers, networked together to allow communication between them and to provide control and feedback of the various parts of the device from a central control room, or even remotely over the internet [4].
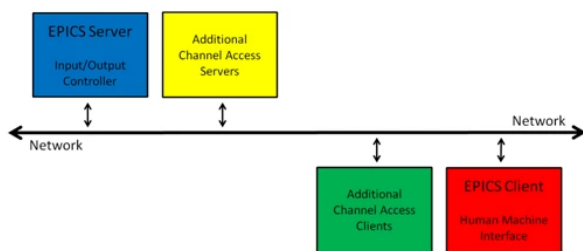
Figure 2: EPICS Network Block Diagram.

IC@MS

Advantages of using IC@MS (Integrated Cloud Ready Alarm Management System):

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. REST API,
5. Multiple access roles,
6. Integration with Active Directory (AD),
7. SMS, mobile or mail notifications,
8. Fast and effective – tested with thousands of alarms.

The IC@MS provides the same functionalities as Panic GUI but also extends it with some new functionalities like adding devices supporting different protocols (Fig. 3). What is important, IC@MS can be integrated with both TANGO and EPICS control system.

KEY FEATURES

Main IC@MS features:

- Alarms list,
- Management of existing alarms,
- Multiple sources of data: EPICS PV, HTTP, MQTT,
- New alarm definition,
- Alarms history browser,
- Multiple searching and filtering options,
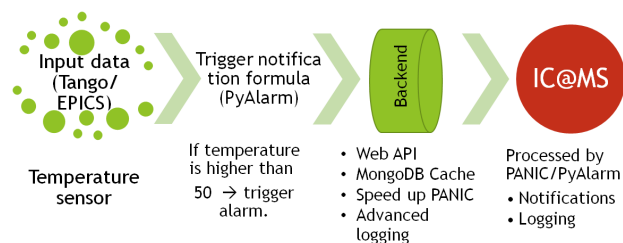- Documented REST API (Swagger).

Figure 3: IC@MS Overview.

Cloud Ready

The IC@MS can be simply deployed to the cloud like Amazon AWS or Microsoft Azure. It lowers operating costs. Moreover, there is no risk connected with server security

and maintenance. The application is accessible via a web browser with only an internet connection.

Alarm Dashboard

The alarm dashboard (Fig. 4) is the view that users see most often. That dashboard presents active and not active alarms. When the alarm is triggered, its color changes following the severity. The most important and recent alarms are shown on top. There are buttons to perform operations like acknowledge, reset or disable the alarms.
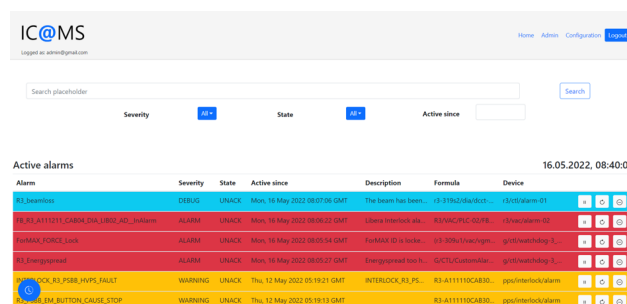

Figure 4: Alarm dashboard in IC@MS.

User can modify existing alarms (Fig. 5) and create new one using the configuration page. To create new alarm user should provide:

1. Alarm name,
2. Receivers (email / phone number),
3. Formula (defines when the alarm will be triggered),
4. Severity.

Fields can be edited.

Figure 5: Creating alarm in IC@MS.

Users And Roles Management

Security is priority, therefore, only registered users can login and manage the alarms. Moreover, to make work with alarms easier, the IC@MS has roles, the user can see easier alarms that he is interested in. Additionally, with Active Directory (AD) users can use the same credentials.

Data Sources and Composers

The configuration page, has option to define new data sources and composers devices (Fig. 6).

Data sources:

- HTTP,
- MQTT,

- Modbus.

Composers:
- Propagate signal from low level device.
- Compatible with HTTP, MQTT, Modbus.
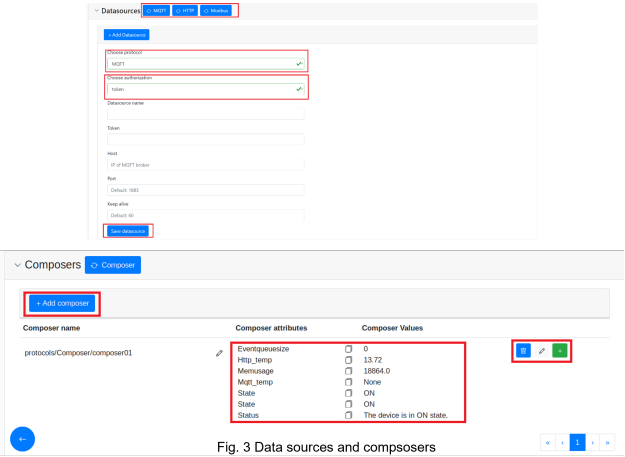- Extract data from different data formats: JSON, XML, HTML, raw strings, Modbus.

Fig. 3 Data sources and compsosers

Figure 6: New data sources and composers.

ALARM HISTORY

One of the most useful functionality is alarm history, which allows users to view the history of alarms including dates, states, and values of formulas connected to the selected alarm (Fig. 7). Moreover, users can browse alarms by date, severity, and other criteria (Fig. 8).

CONCLUSION AND FUTURE WORK

IC@MS (Integrated, Cloud-ready @larm Management System) fulfils all requirements of modern and robust alarm systems. During the tests at particle accelerator facilities, it proves that can process thousands of alarms. IC@MS is continuously improved with feedback from the users.
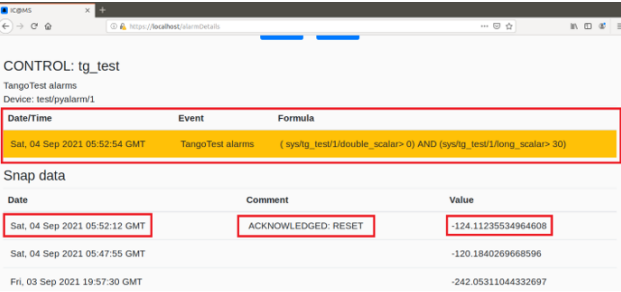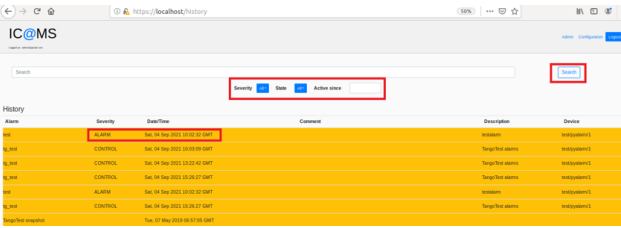

Figure 7: Single Alarm history.

Figure 8: All alarms history.

REFERENCES

[1] TANGO Controls System website, https://www.tango-controls.org/

[2] PANIC documentation, https://tango-controls.readthedocs.io/projects/panic/en/latest/

[3] PyAlarm documentation, https://www.tango-controls.org/developers/dsc/ds/1401/

[4] EPICS Documentation, https://docs.epics-controls.org/en/latest/