



The Monitoring System in IBiSCo Data Center

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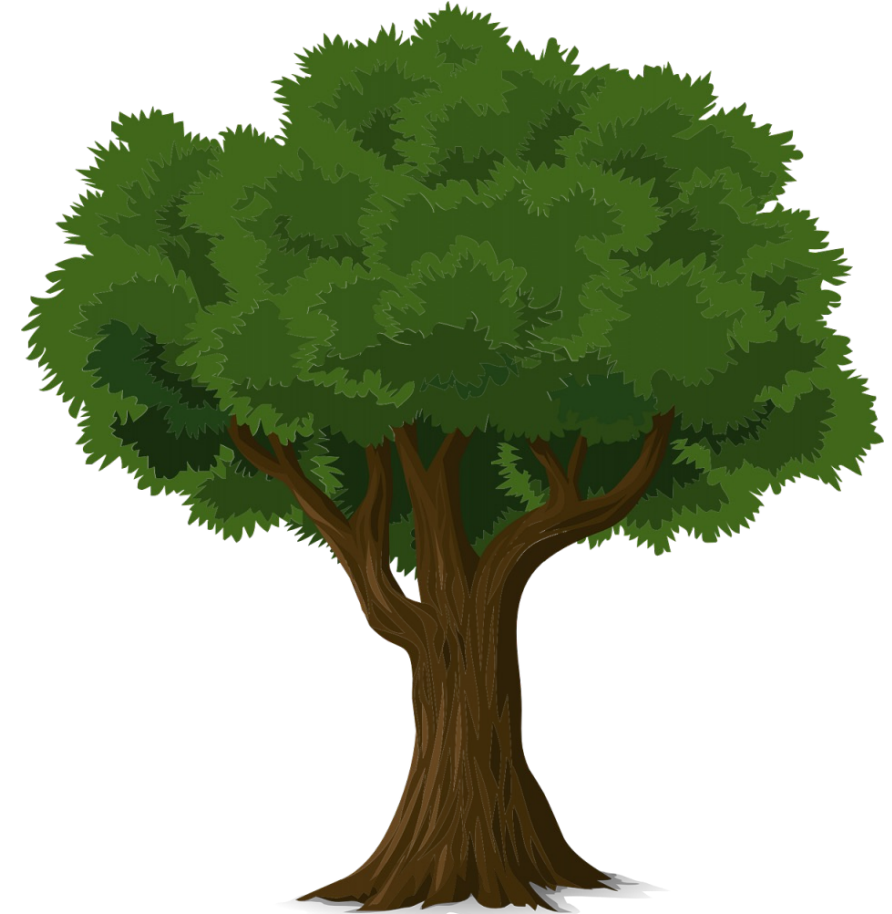
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Outlines

- Introduction and objectives
- Requirement
- Implementation
 - Collect data from:
 - ✓ IT - Server and storage
 - ✓ Network
 - ✓ Power and Cooling
 - Software implementation
- Conclusion and Outlooks





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Introduction and objectives

A monitoring system is software that represents the physical quantities collected and measured by sensors, triggers any alarms and alerts, and allows the activation of actuators.

Objectives:

A good monitoring system:

- Should display the measured quantities immediately and clearly;
- Provide real-time diagnosis of the entire system's status;
- Allow the user to manage or schedule management actions for the monitored system.



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Requirements

Monitoring systems for Data Centers must:

- Monitor the usage of IT resources;
- Monitor data traffic on the network;
- Monitor power and cooling infrastructures;
- Allow management of all resources for effective and efficient use to:
 - Ensure continuous operation of all Data Center equipment and systems;
 - Handle high workloads (computer-intensive);
 - Minimize the Power Usage Effectiveness (PUE).

PUE	Level of efficiency	DCIE
3.0	Very Inefficient	33%
2.5	Inefficient	40%
2.0	Average	50%
1.5	Efficient	67%
1.2	Very efficient	83%

Source: <https://www.42u.com/measurement/pue-dcie.htm>



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Implementation: IT Resource

Measured quantities:

- Percentage of GPU and CPU usage for HPC and HTC servers
- Operating temperature
- Used RAM
- Free disk space
- File system status
- Status of storage disks and NVMes, and tape drives





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Implementation: Network

TCP/IP Protocol

OpenMP and Lustre file system



1 Gb/s



10-25 Gb/s



100Gb/s

九州云聚
9100-008

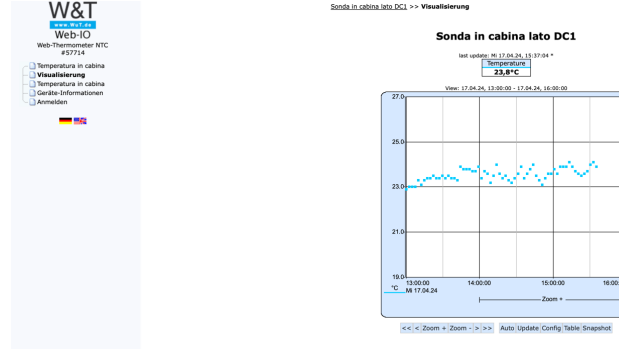
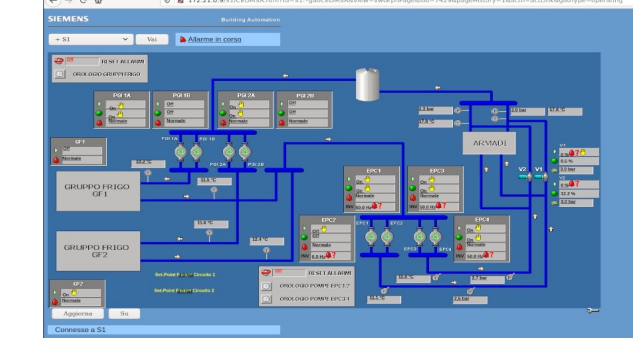
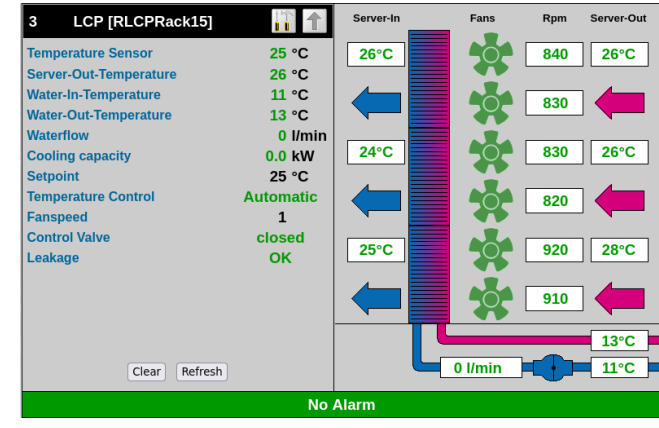
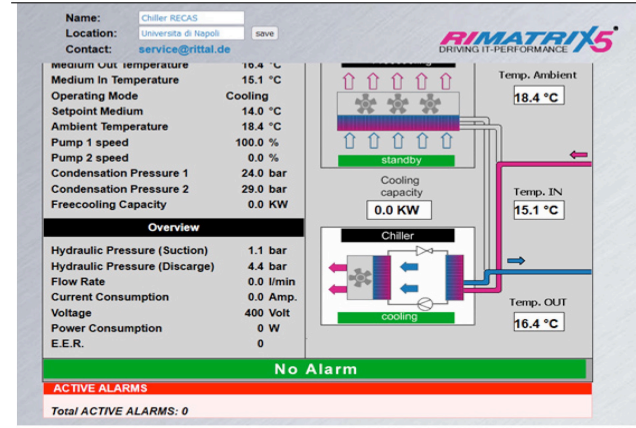
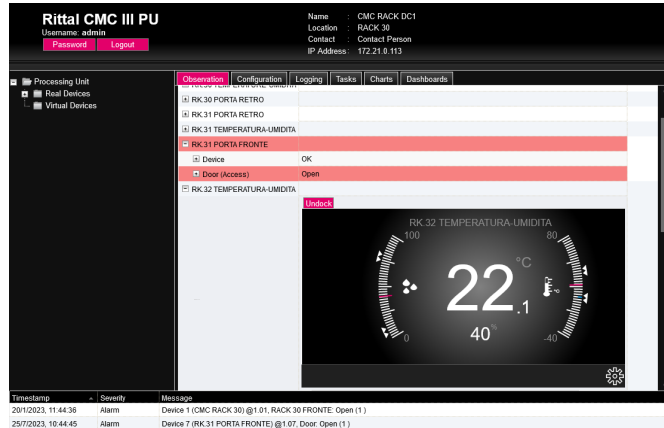


200 Gb/s
Infiniband



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Implementation: Power and cooling





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Implementation: the monitoring method

Monitoring without agent	Monitoring with agent
Protocols integrated into the devices (e.g., SNMP) transmit local data to the central monitoring software.	The agents installed on the devices transmit local information to the central monitoring software.
Limited data collection	Detailed data collection
Reduced maintenance needs	High maintenance needs
Low CPU load and low memory usage	High CPU load and high memory usage



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Software implementation instruments

1. SNMP (Simple Network Management Protocol)

a protocol that allows devices on a network (nodes) to exchange information through a Client (agent) – Server (manager) model with a tree structure, where the branches are MIB (Management Information Bases) tables.

2. RRD (Round Robin Database)

Circular buffers with a fixed size that allow storing large amounts of information on time series.

3. Recording data in a database stored on disk.

The system was developed in Python and uses the RRDtool library to create and feed RRDs and to generate plots from their content.



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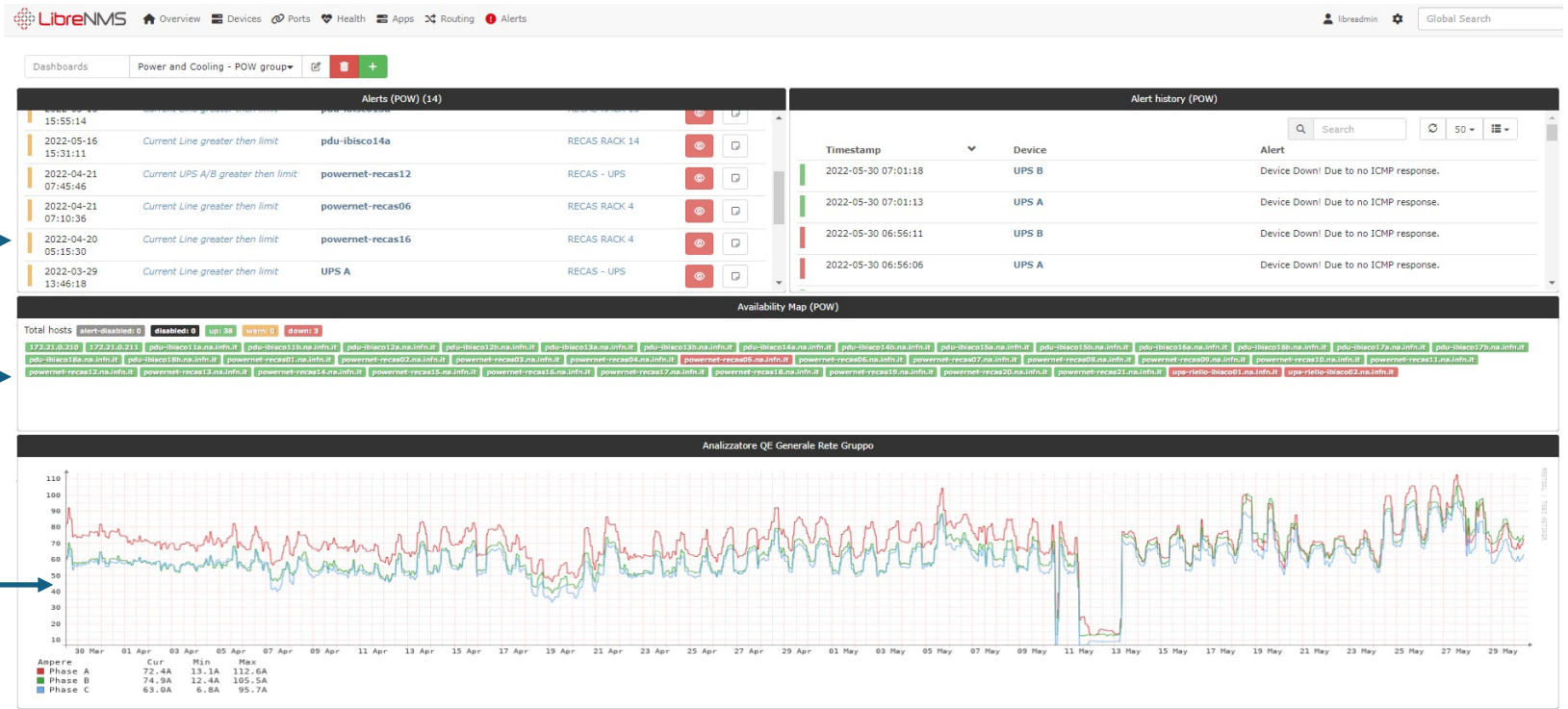
Our monitoring software

The graphical interface was developed using the LibreNMS libraries.

Events and alarms list

Item list

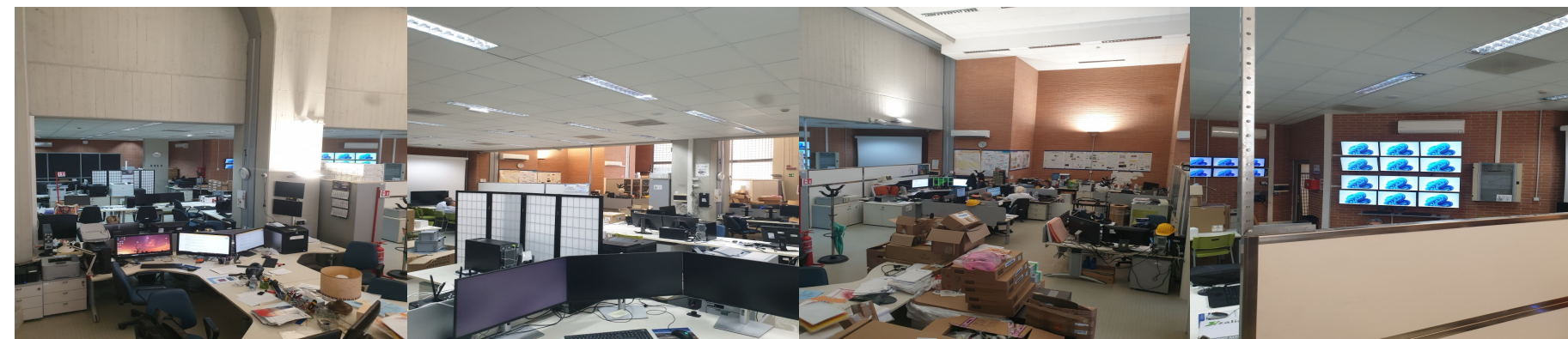
Plot of data in time function





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The monitoring stations



Monitoring system
in Control Room

INFN Monitoring system





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Conclusions

- During the IBiSCo Project, a monitoring system was developed for all the participating entities for the two Data Centers at Monte Sant’Angelo;
- To design the system effectively, sensors were installed for measurement detection and actuators were added by updating the existing infrastructure;
- The first complete version of the monitoring system was implemented for DC2 at Monte Sant’Angelo;
- For DC1, research and thesis work were carried out to monitor the traffic on the InfiniBand networks.



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Outlooks

- Updating and improving the current monitoring system for the two Data Centers;
- Increased compatibility with actuation systems;
- Creation of a platform for monitoring maintenance interventions



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Thank you for your attention

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