PcVue Solutions Hypervision

Infrastructures & buildings

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Confidentiality :	Public

PcVue Solutions

Content

Hypervision of buildings

1. Introduction

Current buildings and infrastructures are increasingly complex and must respond to 3 main issues:

- Regulatory requirements to optimize energy consumption,
- Strong expectations in terms of comfort and services provided to occupants,
- A necessary profitability

These issues are reflected in particular by the need for buildings:

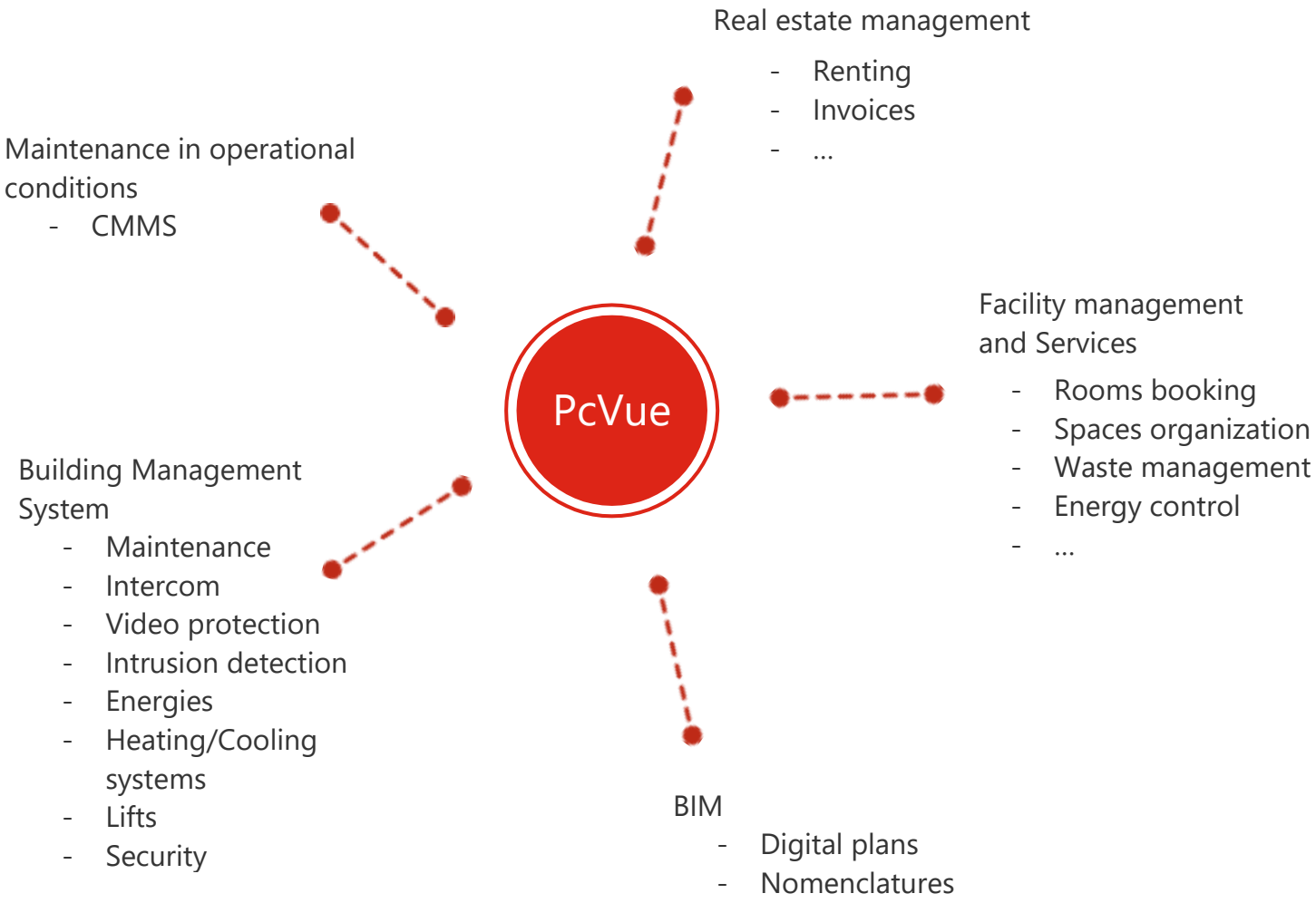
- Optimize the operation and maintenance of technical installations
- Provide more services to occupants
- Guarantee the proper functioning and sustainability of the installations while allowing their development
- Aggregate the data of all services and allow their operation in a unified and centralized manner

A building is made up on the one hand of different technical packages (comfort, energy, CFP, Intercom, intrusion and video surveillance, elevators, fire detection) which each have their own specificities which translates into "proprietary" subsystems. heterogeneous equipment.
On the other hand, a set of services (asset management, weather forecasting, space reservation, etc.) are available via different systems that are independent of each other.

The resulting difficulty in interoperability makes data aggregation complicated and overall operation difficult or even impossible with the consequence of not being able to respond effectively to the issues raised.

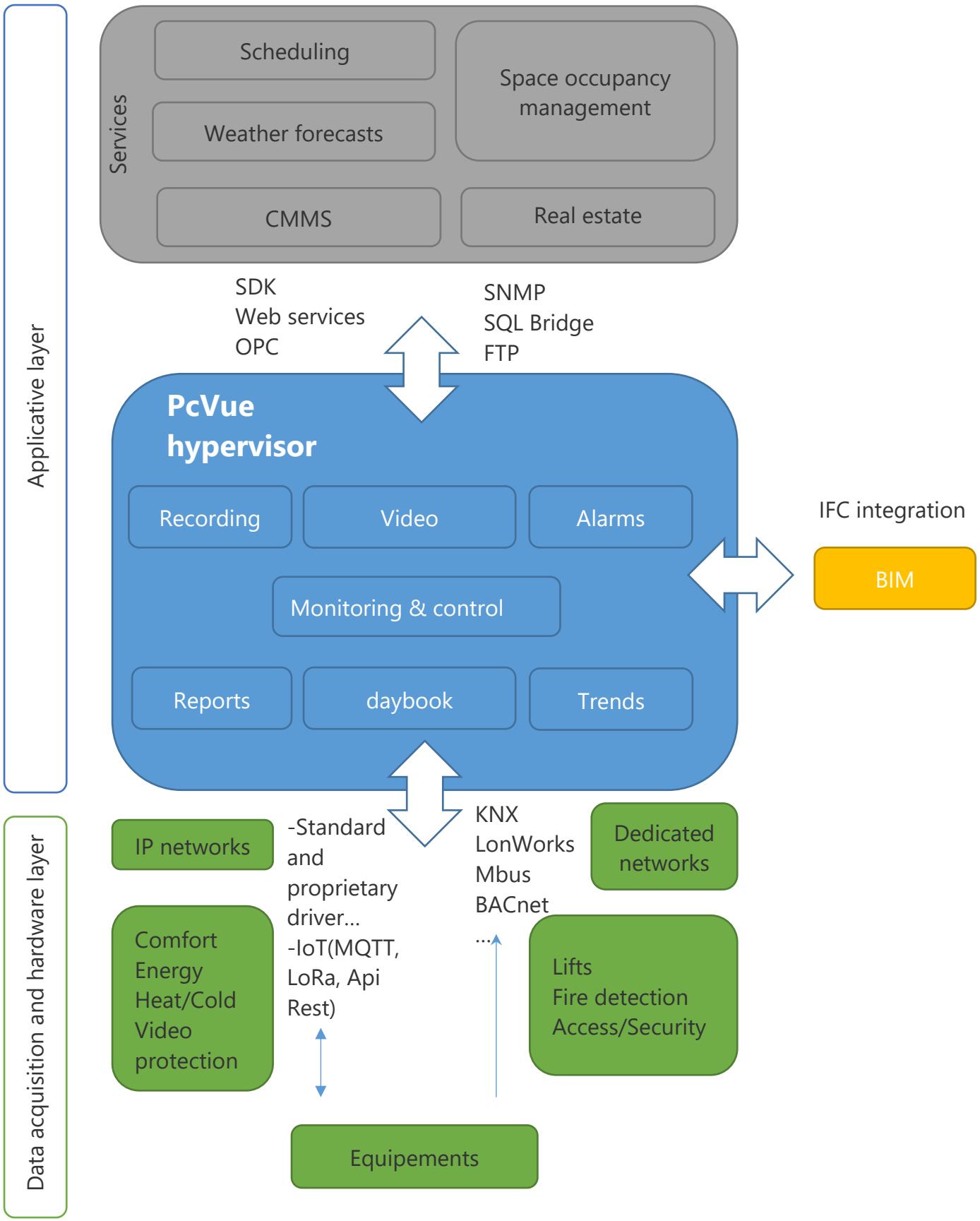
2. PcVue hypervision platform

The findings described above lead us to consider a hypervisor or BOS[1] type solution that brings together the different subsystems within a single platform to efficiently operate and maintain a building.



[1] BOS: Building Operating System

3. Architecture



At the level of communication layers, PcVue integrates communication protocols capable of connecting equipment to IP and / or dedicated networks.
At the level of the PcVue application layer:

- recovers the BIM operation information and allows the visualization of these in real time and animated way on 3D representations
- interfaces with all building services via the many connectors and exchange standards available natively in PcVue

4. Main features

During the **design phase**, the platform must be sufficiently open and scalable to integrate new systems while minimizing the impact of changes.
During the **operational phase**, it must centralize and correlate data from various origins through a single interface for visualization, management, analysis and processing.

PcVue thus meets the characteristics and supports the following functions:

• Unique development platform mainly based on configuration and parameter setting limiting the functions performed by programming.

• Use of a structured system input / output database allowing a generic approach.

• Interoperability and communication with all subsystems (comfort, energy, Heat/Cold, intrusion and video protection, access control, elevators, fire) and equipment.

• Graphical interface respecting the standards of Microsoft platforms with animated synoptics, allowing the visualization and the control of the values of the system, using a mouse or by touch screen.

• Real-time visualization and control of installations via an HMI with the possibility of visualizing telemetry and controlling remote settings from a landline or a mobile device

• Native mobile technology allowing a nomadic user to automatically obtain contextual information related to his area of responsibility (maintenance, operation, etc.) in the area where he is located and to have direct access to the actions he can take. from his mobile. He will thus be able to control set points, analyze trends, consult a document... and even exchange messages with other mobile users.

• Real-time feedback of events and alarms from all technical equipment centrally but also directly to operators with mobile devices

• All the data reported must be able to be archived to an open SQLServer database allowing use by other third-party systems. PcVue will allow various means of exploiting these archives for short, medium and long term analysis such as statistical extraction into Excel files, editing of reports and balance sheets, or even visualization of curve monitoring.

• Monitoring of energy performance and restitution in the form of dashboards, curves or balance sheets and reports.

• Scalable and flexible PcVue is able to adapt to changes to support the extension of a building without the need to redevelop everything. It allows the supervision of a single building as well as of several buildings.

• PcVue is based on an object-oriented solution making it possible to easily manage and modify interior spaces (offices, etc.). For this, he will have:

- An integrated environment allowing the modeling of a process or a functional unit and easy deployment via instantiation mechanisms.
- A library of pre-animated objects that can be edited online without an external tool,

• The backward compatibility of the versions of PcVue is ensured and allows the installation of new versions of the software, without modification of the project data.

• In order to ensure service continuity and maintenance in operational conditions, PcVue has project version management.

5. Field data acquisition and interoperability with third-party systems

PcVue offers great communication capacity with field equipment as well as great interoperability to communicate with third-party systems using open and standardized interfaces.
All smart building standards are supported, but also others allowing the system to be integrated into a larger whole (Smart Grid, Smart City).
A single platform will be used to harmonize data from all types of interfaces to give them the same appearance and the same operating methods without having to worry about where they come from.

PcVue will natively integrate communication control functions and will provide a set of statuses concerning the quality of exchanges. These statuses will be directly exploitable through variables of the software's real-time database (system variables). They can therefore be used in all the functions of the supervision software: animations on synoptic diagrams, alarm windows, logs, programs, on-call call ...

To complete the mechanisms for detecting communication anomalies (response timeout or absence of a correspondent), PcVue will natively manage without programming, a "life bit" principle in relation to the PLC program. Thus it will be possible to detect a possible freezing of processing of the PLC even if the latter's coupler responds correctly to communication requests.

In addition, the following features will be supported:

- The time-stamped mode at the source will be managed for the protocols that offer it
- Data timestamp to the millisecond with collation in the histories
- Display and historization of the origin of the time stamp (equipment or supervision software)
- Native management of redundancy functions (servers, Ethernet networks, PLCs)

5.1 Field protocols

PcVue communicates with acquisition, control and automation systems (programmable logic controllers, remote input / output, regulators, etc.) and natively has a set of protocols, serial and TCP / IP, covering the main manufacturers of devices including standard building protocols, such as (full updated list available on our website:https://www.pcvuesolutions.com/index.php/support-a-services/resources/communications-drivers):

- BACnet which is certified by the BACnet test laboratory as BACnet advanced station software (BTL B-AWS) guaranteeing the highest level of BACnet integration

- SNMP Manager / Agent available in versions v1, v2, v3 (integrating security functions)

- OPC
OPC DA (v1.0, v2.0, v3.0) Client / Server,
OPC UA (v1.03),
OPC XML (v1.0)

- LonWorks supporting all LNS versions available from Echelon which will allow, among other things, to benefit from online modifications of LON DB (Polling / Binding).

- KNX

- ModBus
    Modbus / JBus serial,
    Modbus / TCP

- IoT
    LoRa,
    MQTT

- KNX

- ModBus / JBus, Modbus / TCP

- File recovery from FTP servers

5.1.1 Communication LonWorks®

When setting up a LonWorks® network, interoperability is guaranteed by the publication of the LonMark® profiles used.

When you want to establish communication with a LonWorks® network, it is necessary to have an original manufacturer or compatible communication interface (PCLTA communication card or Lon / IP interface) as well as a installation and administration of the network under LNS® (LonMaker For Windows® or NL220). The interface between the supervisor and the LonWorks® network is a software component provided by ECHELON® and which uses the resources of the LNS® LCA Object Server. The installation of this supply is therefore the necessary prerequisite for the use of this type of network within the supervisor.
The LNS® database created by the installation tool is directly operated by the supervisor, which facilitates the configuration and maintenance of your application.

The LCA Object Server communicates with the devices declared on the network and updates the supervisor variables.

The supervisor meets the following requirements:

- be compatible with the OPEN LNS version of Echelon®,
- support SNVT and UNVT variables,
- provide the "Configuration Properties" of the equipment (SCPT and UCPT variables),
- recognize the "LonMark® Objects" and execute the "Plug-In" made available by the manufacturers.

5.1.2 Communication BACNET B-AWS

PcVue will be able to communicate with the equipment of a BACNET IP network.
For obvious reasons of reliability BACnet will be certified by the BACnet test laboratory as BACnet advanced station software (BTL B-AWS) ensuring the highest level of BACnet integration. This communication must be done by means of a native interface.
The representation of information from BACNET equipment must be done in accordance with the object logic of the BACNET protocol. This information will be accessible (read and write) as object properties.
All the services offered by the standard (BIBBs) will be supported:

- Real-time data feedback
- By scanning
- In unsolicited mode (COV)
- Alarm and event notifications
- Viewing alarms sent by notification of the equipment and transmission of the supervision acknowledgment to the equipment
- Trends and event logging
- Automatic reading according to a configurable period,
- Automatically play on receipt of a notification,
- Playback on demand from the app
- Time programming

- Setting up calendars, time tables and intervals
- Network and equipment management
- Support for segmentation functions (FDT-BBMD)

All configuration, diagnostic and debugging functions required for BACnet will be integrated into the supervision software, including:

- Functions for discovering BACnet equipment and objects,
- Configuration import tool for BACnet,
- Tools to help application developers conduct diagnostics on the operation of automation objects without having to use the equipment programming console

5.1.3 Communication SNMP

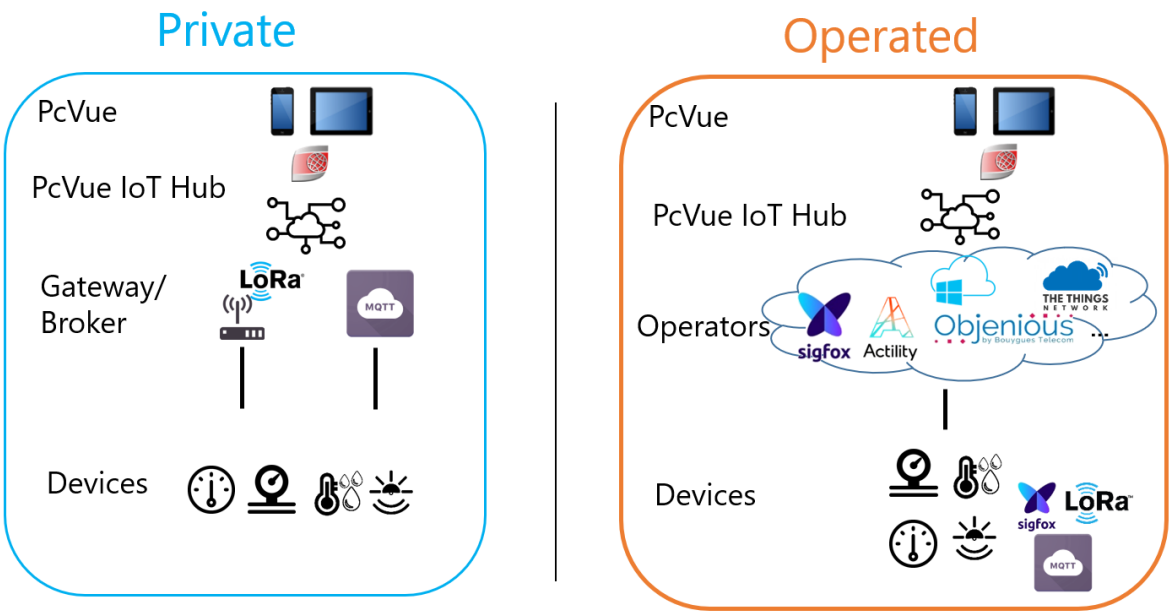
PcVue must have the SNMP manager and agent protocol natively with support for versions V1, V2 / V2c and V3 (integrating security functions).

PcVue will support the following functions:
- MIB online or offline
- Provision of standard MIB files
- Advanced trap management
- Modeling of networks and SNMP equipment
- PING management for non "manageable" equipment
- Optimization of exchanges and redundancy mechanisms
- Provision of information from the supervision software for an SNMP manager such as a network supervision system.

5.2 IoT Protocols

The supervisor will provide a set of components, functions and services grouped together to:
- Connect sensors or "objects" through IoT protocols
- Implement and create IoT elements in a project
- Operate and maintain an installation using connected objects by valuing the data collected

The supervisor will have to connect “IoT” objects independently of the manufacturers, on private or operated networks and is compatible with most networks (LoRa, sigfox), operators, protocols (LoRa, sigfox, MQTT, etc.) and sensors on the market.
It will be compatible with many gateways including “Node-Red” gateways.
It will natively integrate the LoRA protocol and the MQTT protocol.



6. Interoperability with 3rd party systems

In addition to communication with field equipment, PcVue ensures interoperability with various external systems when creating a possible hypervisor and will provide standard communication interfaces such as:

- A development environment (SDK) allowing the user to integrate any specific protocol (Ethernet TPC / IP).
- Web Services functions allowing other systems (Web server, Intranet, etc.) to access data from the supervision software via a Web server
- A generic external configuration import tool
- An OPC client / server interface
- The SNMP agent protocol to provide data for the supervision software which can thus be supervised by network supervision systems
- Import / export of text files (csv, XML, ...)
- File recovery from FTP servers
- Universal data connector based on a native SQL query manager to exchange data with any ADO.net provider.

7. Remote access

7.1 EasyMobileTechnology

Web and mobile solutions of PcVue lean on an exclusive technology EasyMobileTechnology allowing to setup mobile architecture with no gateway/plug-in, embedding all the necessary security features (https, Oauth, certificates) and the HTML5 technology as well as maintenance tools.

This technology fits the following criteria:

- No gateway, no extra plugin
- No installation on client side
- Easy settings – no scripts – Wizard only
- Open to third-party application
- Adapted to any users: end-user, SI, IT
- Secure scalable architectures and communication
- Easy Diagnostic

7.2 Web deployment console

The web deployment console is a component for setting, deploying and maintaining a web or mobile architecture.
It supports the following features:

- ✓ Deployment of web services and web apps on IIS
- ✓ PcVue Web Back-end endpoint management
- ✓ Data protection management
- ✓ Certificate management
- ✓ User access logging & OAuth Server management
- ✓ IIS auditing / diagnosis

The web deployment console runs on a server hosting a web server IIS.

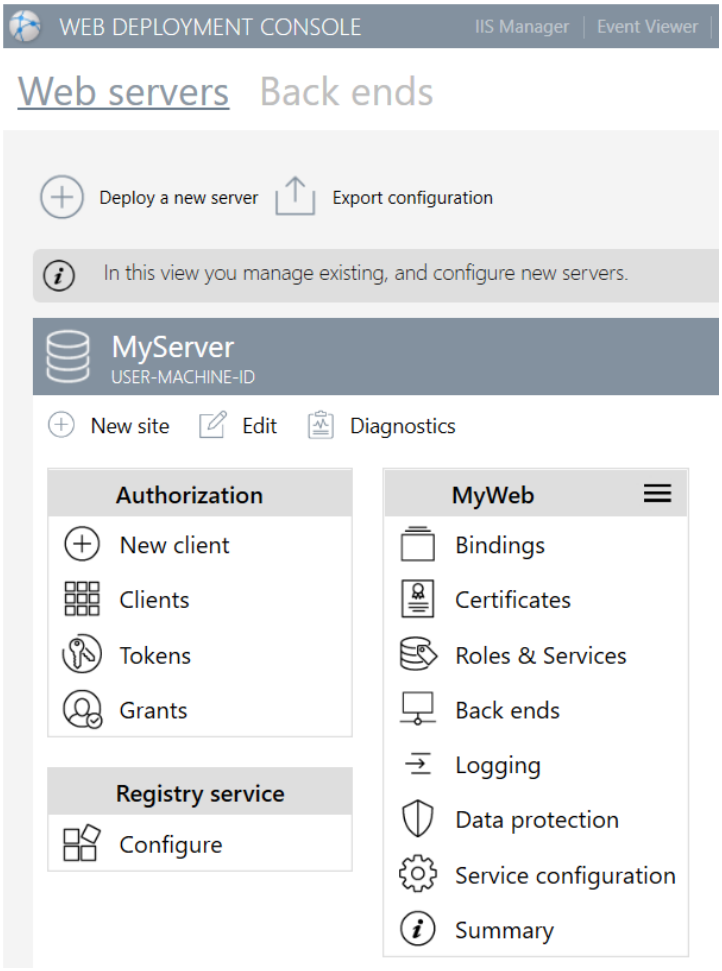


Figure 1 - Web deployment console interface

7.3 HTML5 Web client

WebVue uses an ordinary web browser and an internet or intranet connection to provide remote display and control of your processes. A user with appropriate user rights (user name and password) is able to access the PcVue SCADA application from anywhere on the network. WebVue is independent of the operating system as it runs in a web browser and it displays PcVue mimics directly without requiring any modification.

Communication between the PcVue Web Server and the WebVue client uses Microsoft IIS technology and the enterprise firewall jointly to manage security. The WebVue client is continually refreshed and data exchanged using HTTP, or HTTPS if encryption is required (SSL V2).

WebVue is compatible with the main web browsers. Using PcVue's public Web Services you can also create a custom web portal to access the real-time and historical data of PcVue on mobile phones, tablet PCs etc. via standard web pages.

7.3.1 WebVue Features

- HTML5 technology
- Real time monitoring and control and access to historical data, trends and events are possible from the web client interface for an operator with appropriate user rights.
- The mimics displayed on the web client look the same as the mimic visible from the SCADA stations clients or servers.
- It is not necessary to develop specific mimics and views for the web client capability. Meaning the mimics develop for the SCADA application are automatically compatible with the Web Client. This in order to avoid extra engineering and to allow operator users to be immediately familiar with the Web SCADA interface.
- It's possible for a user with appropriate user rights to log in to the web client application through intranet or internet using a standard web browser from the market.
- Auto log off feature to automatically log off a user connected to the web client after a determined inactivity period.
- Facilities for remote commands and acknowledgement of alarms
- (according to user rights)
- No software installation necessary on the remote station
- Optimized data exchange for mimic updates
- Encrypted data exchange to prevent problems of hacking
- Access to PcVue data server via IIS in XML SOAP
- Station for production maintenance staff, or for all occasional users
- Several users may be connected simultaneously to the supervisory application managed by the web server station
- Several connections are possible on the same webbrowser using several tabs
- No license required on the client station
- An operator with Web Client access has the same rights from the Web Client interface as on the SCADA application itself.
- Up to 50 web client connections shall be able to access the supervisor concurrently
- There's no limitation to the total number of potential web user.

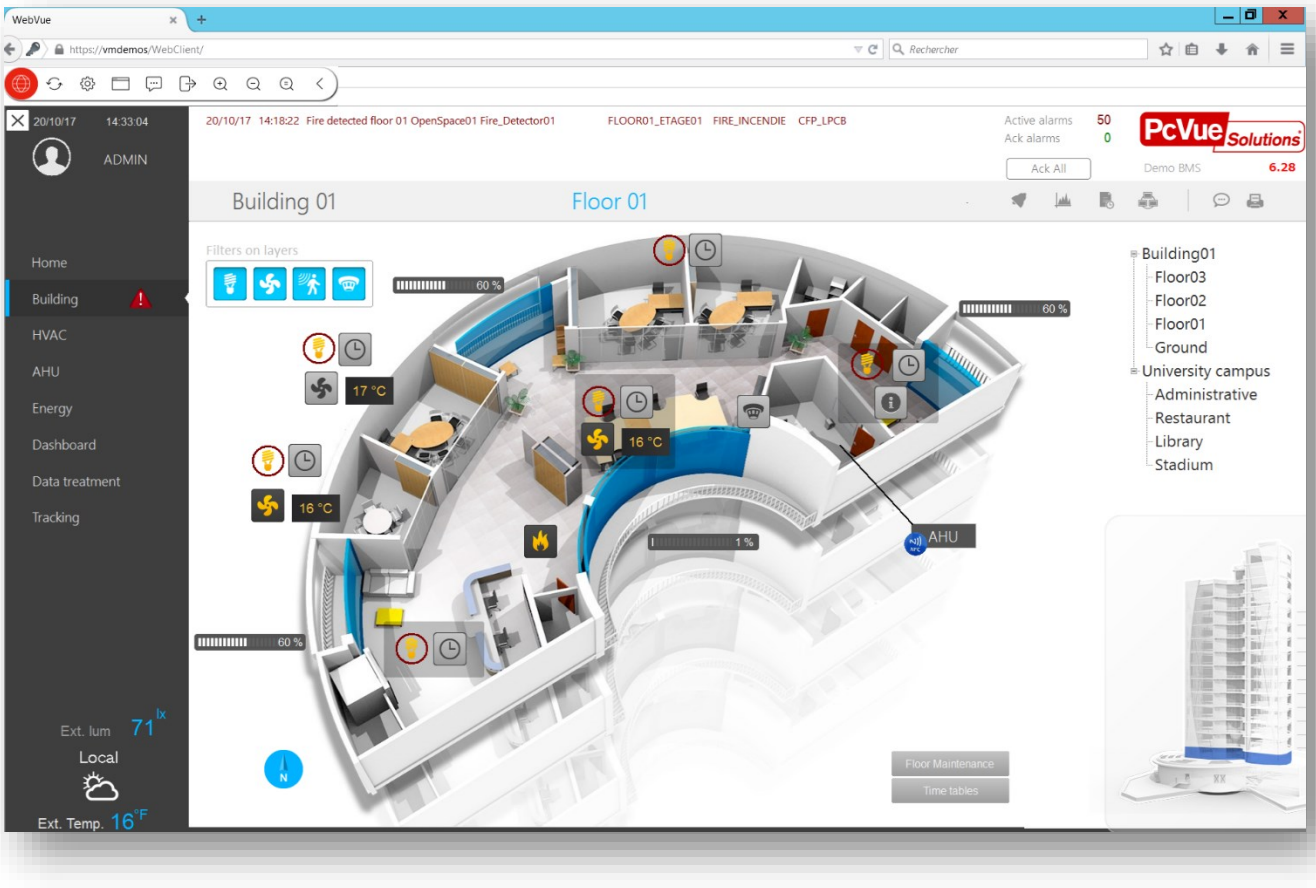


Figure 2 - Mimic displayed in WebVue

Some restriction may apply when using a WebVue client :

The following animation types are not supported: Grid Control Recipe Region Timetable

- The use of substitution strings for opening mimics is not supported (#I, #P, #U, #M11 to #M20).
- The form controls are supported but their appearance is slightly. The intermediate state of a check box or radio button form control is not available. You cannot use variables with Form Controls for mimics displayed in WebVue.
- The Trend, Alarm and Log Viewers have some limitations on their functionality.
- AVI (multimedia) files are not supported.
- If a mimic is repeated in the Supervisor's Workspace, only the first instance appears in the WebVue Client.
- The options available when entering a text string or register value are limited.
- There is limited support of pop-up (child) mimics.
- Limited use of function keys.
- The Zoom feature is not available.
- There is limited support of fonts and styles. Fonts will generally be supported if they are installed both on the Supervisor's station and on the browser of the WebVue

Client's station. The fonts Arial, Courier, Times New Roman, and System are widely supported. Regular, italic and bold styles are supported; underline styles are not.
• Control zone animation accelerator keys are not supported.
• ActiveX controls in mimics are not supported.
• OLE objects in mimics are not supported.
• VBA and Enable scripts not supported.
• Limited support for SCADA Basic instructions and modes.
• 3D mimics not supported.

7.4 Remote access

PcVue supports the feature « Remote Desktop Services » which allows instances of PcVue to run remotely using any devices that supports Remote Desktop, including HTML5 compatible devices.
This allows a user to access the PcVue application remotely with exactly the same features as a local client station.
This solution offers a high level of security since only the keyboard and mouse activities transit over the network reducing the risk of data corruption.

7.5 TouchVue - Mobile application with alarms & events notification services

It is possible to access data from a PcVue project from a tablet or smartphone using the TouchVue mobile application for PcVue.
TouchVue is an application displaying information and enabling actions on variables provided by the mobile server of PcVue ,. The variables displayed are those whose level of navigation corresponds to the configuration of the TouchVue user profile.
TouchVue runs on the Android operating system (5.0 or higher), it also works in a web browser on any SmartPhone[2].

This application offers the following notification and control services:
• Notifications of alarms in real-time
• Access to real-time alarm list
• Alarm acknowledgment
• Access to the list of archived events
• View real-time data trending and archived
• View real-time values
• Sending commands and instructions

The implementation of this solution is done simply and without specific development.

[2] Notifications are not available in this environment

A simple setting made via check boxes in the PcVue project allows to define what type of data will be available on mobile. In addition, access to data and the level of visibility and control of these depend on the user profile and the rights associated with it in the PcVue project.

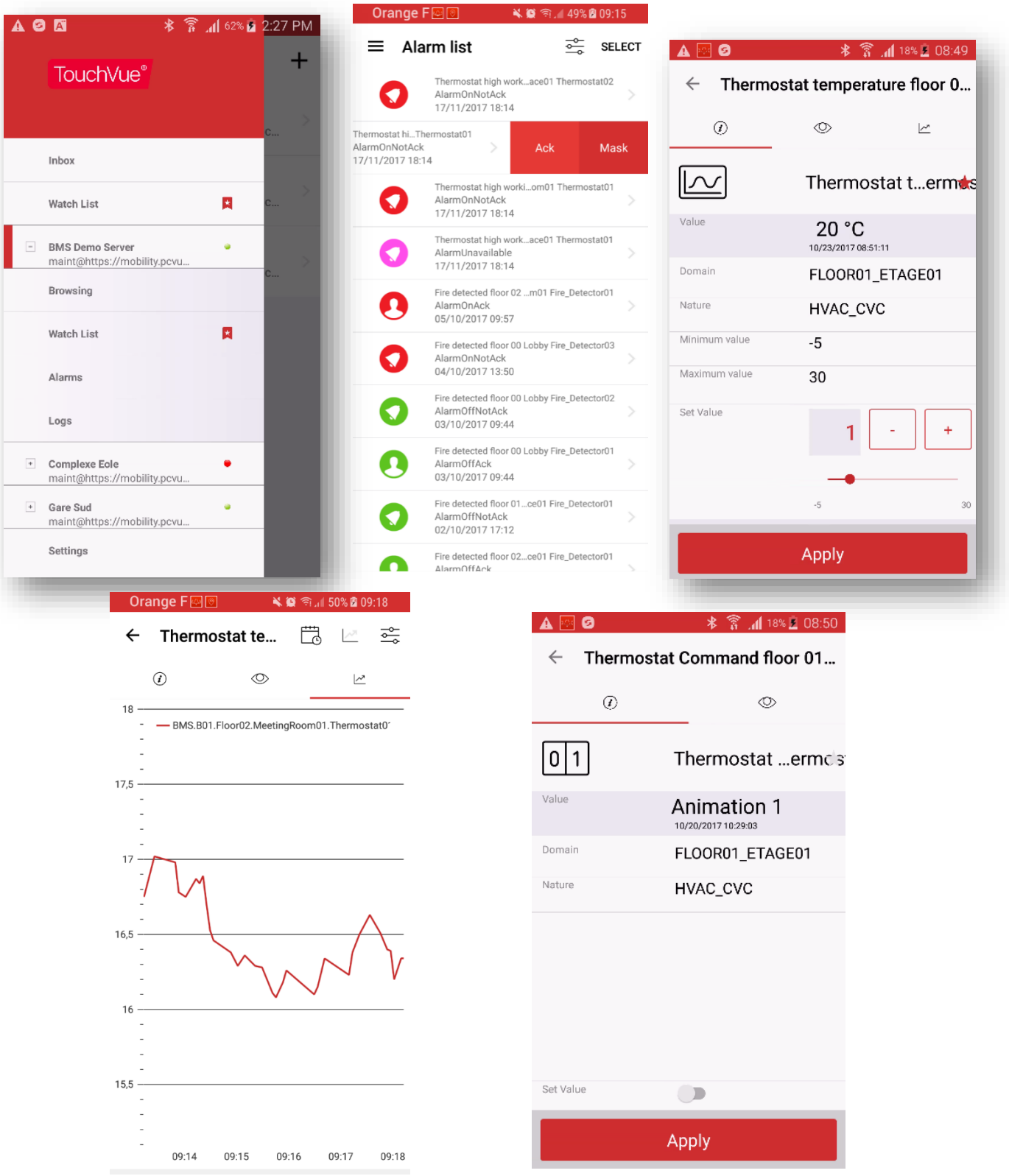


Figure 3 -TouchVue screenshots

7.6 Geolocation and contextual mobile app

A mobile application will allow a user, depending on his / her profile, to automatically obtain the contextual information related to his / her area of responsibility

(maintenance, operation, etc.) in the zone where he / she is and to have access to the actions he/she can undertake, directly from his mobile. It will be able to control the set points, analyze trends, consult a data sheet or exchange instant messages with other stakeholders.

This mobile application will be based on the existing internal / external geolocation technologies (bluetooth tags, NFC chips, QRCodes, GPS, WiFi, ...) and will allow in particular the following functionalities:
- Automatic display of contextual information according to the geographical area in which the user is located and his profile
- Visualization and control of equipment in the vicinity
- Instant messaging with text, audio or video messages, and images
- Localization of mobile devices from a server visible on the synoptics through animations or on an interactive map (Google map, ...)

This application should facilitate the interventions of nomadic users who do not necessarily know the site well by presenting the relevant information concerning the tasks to be accomplished without having to navigate through a multitude of menus.

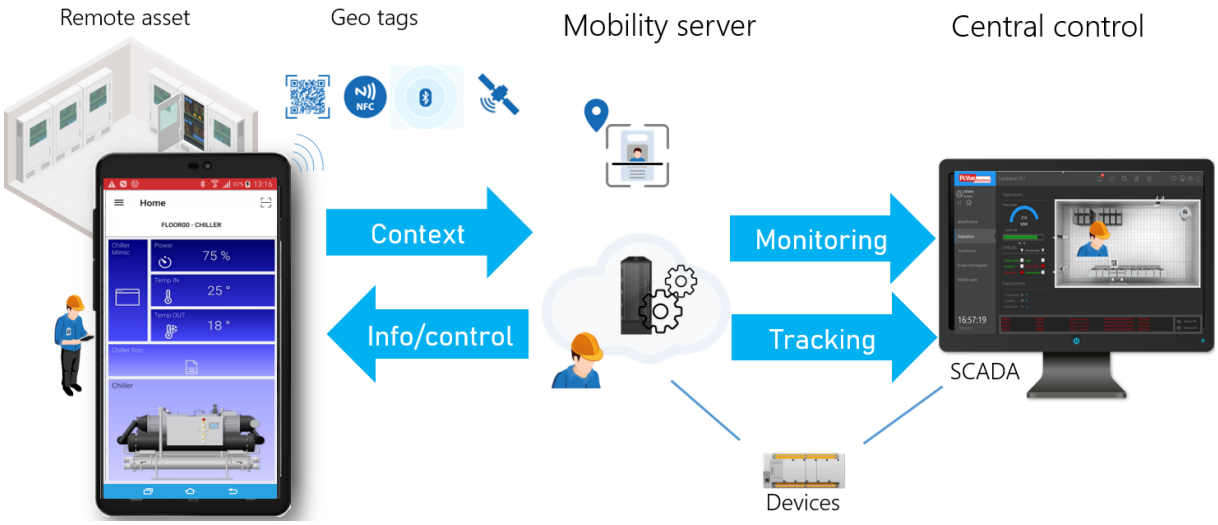


Figure 4 – SnapVue : concept

SnapVue uses geolocation technologies and services as shown below:

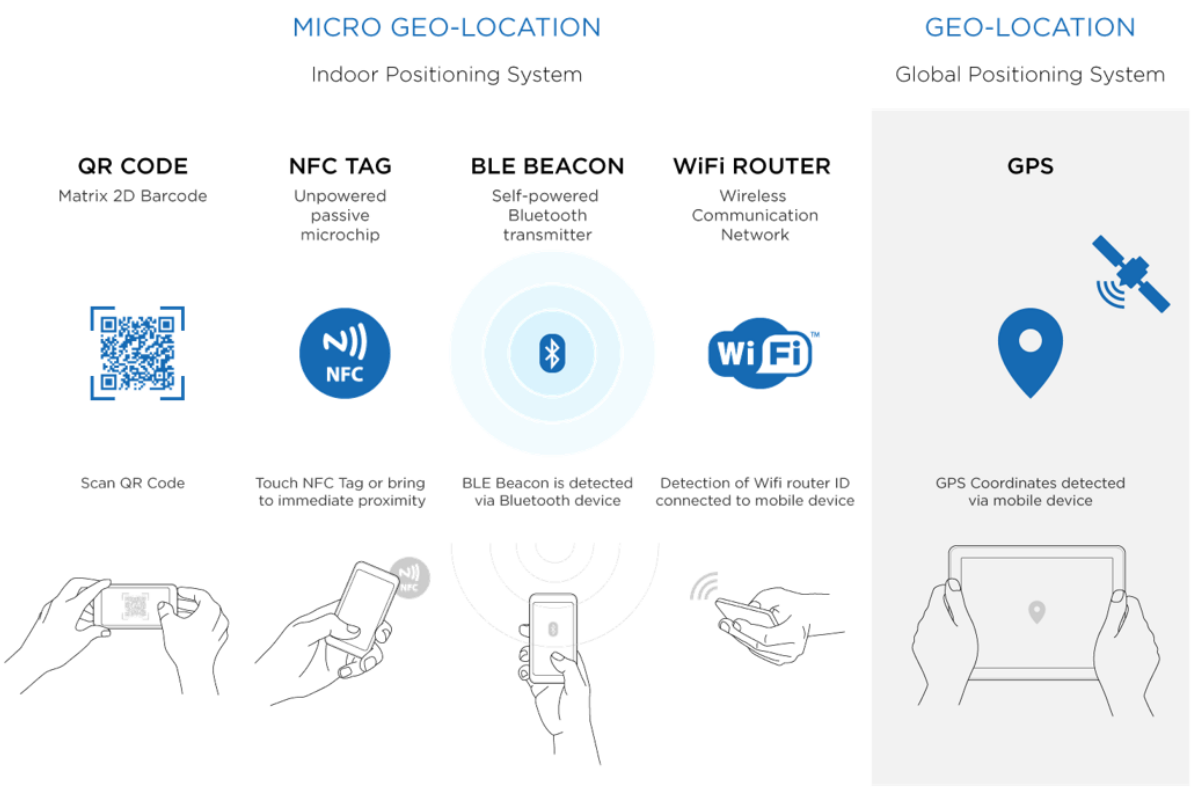


Figure 5 – SnapVue : technologies

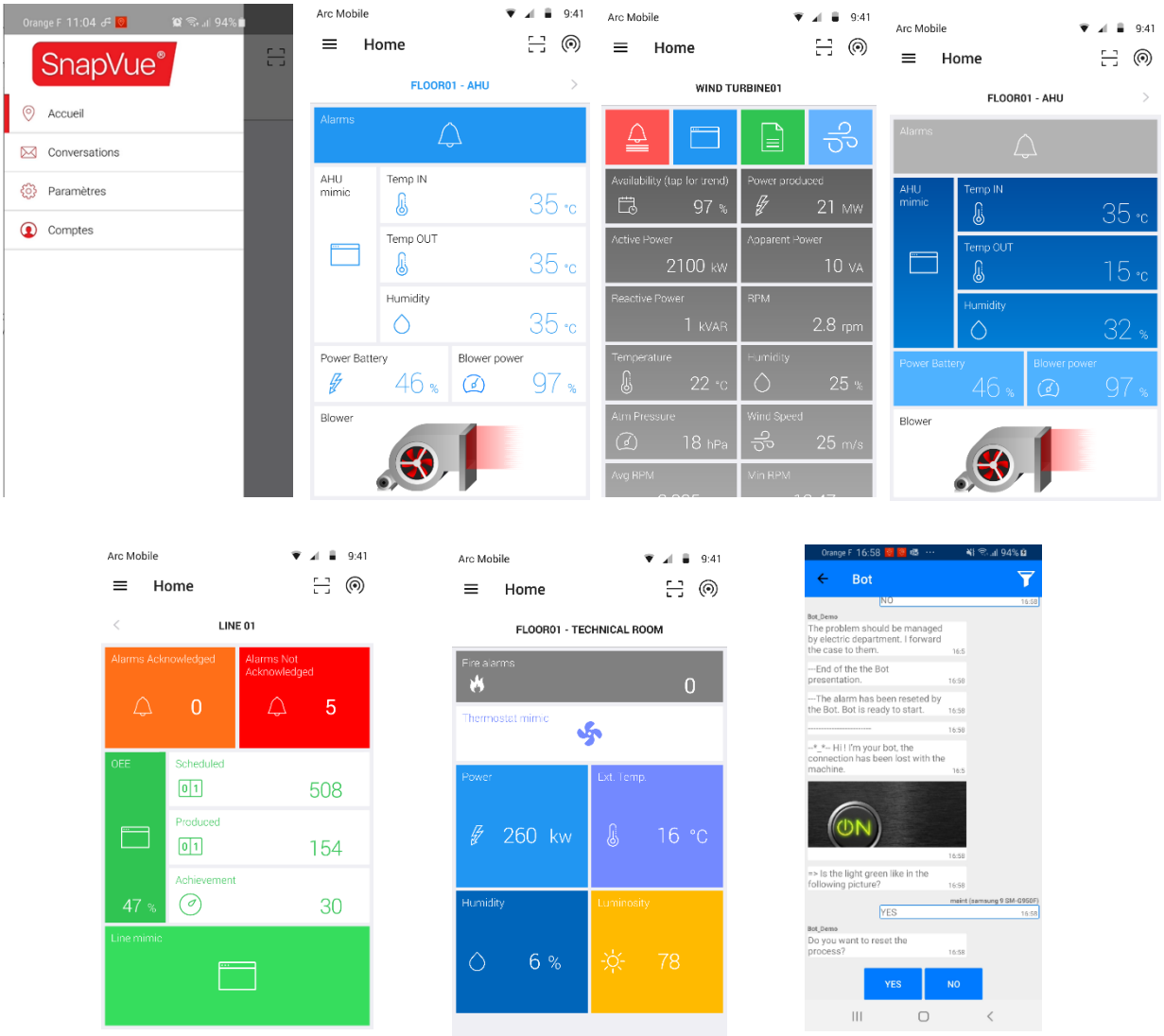


Figure 6 – SnapVue : screenshots

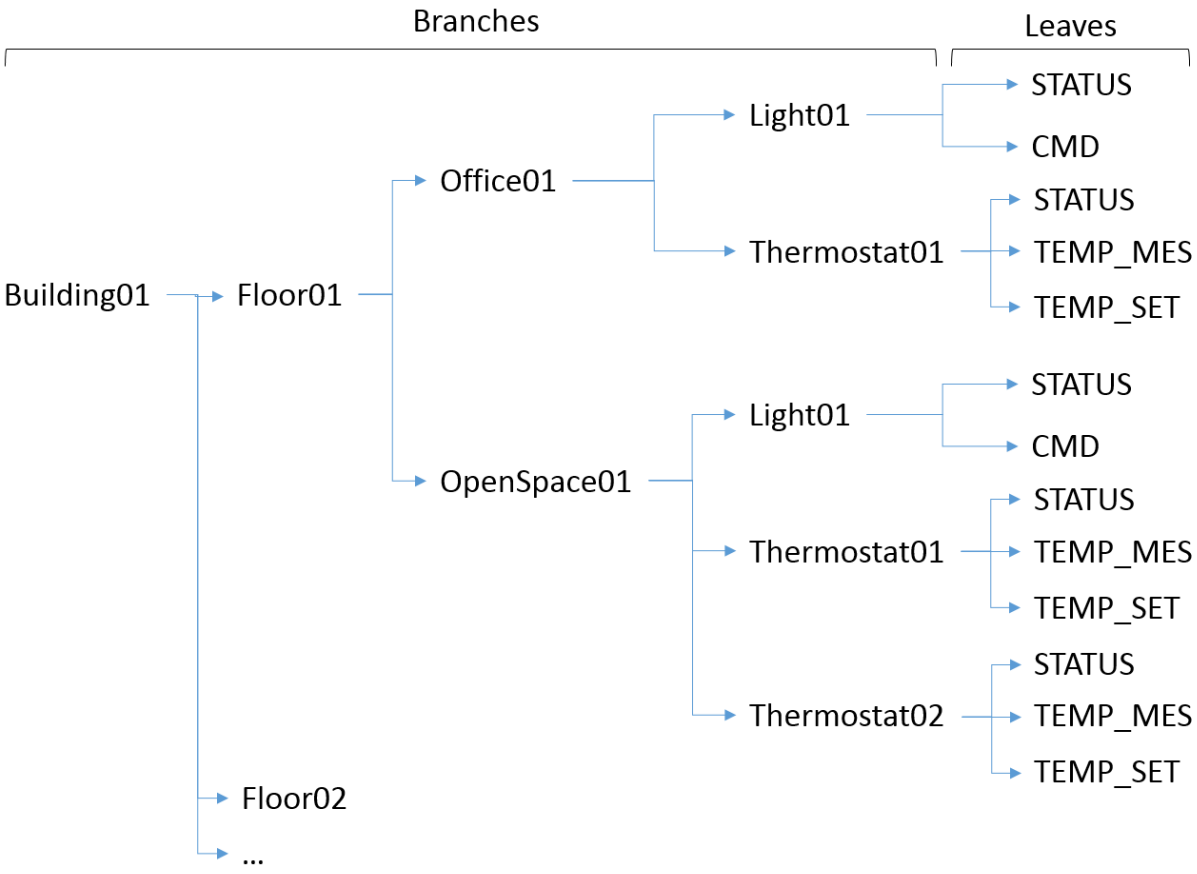
8. Real time data

Real-time data is the heart of the monitoring software. A set of variables also called "tags" contain the input / output data that will be used in the mimics for display and commands. The variables will also allow the triggering of actions or recordings as well as various treatments.

8.1 Structure

The input / output data will be represented in PcVue by variables according to a hierarchical tree structure, in the form of a tree, allowing a structured organization of the data, corresponding to the supervised physical process.

For example, a building may be modeled as follows:



Each line defines a variable composed of several branch levels and one leaf. This variable tree is displayed in the Application Explorer as shown below:

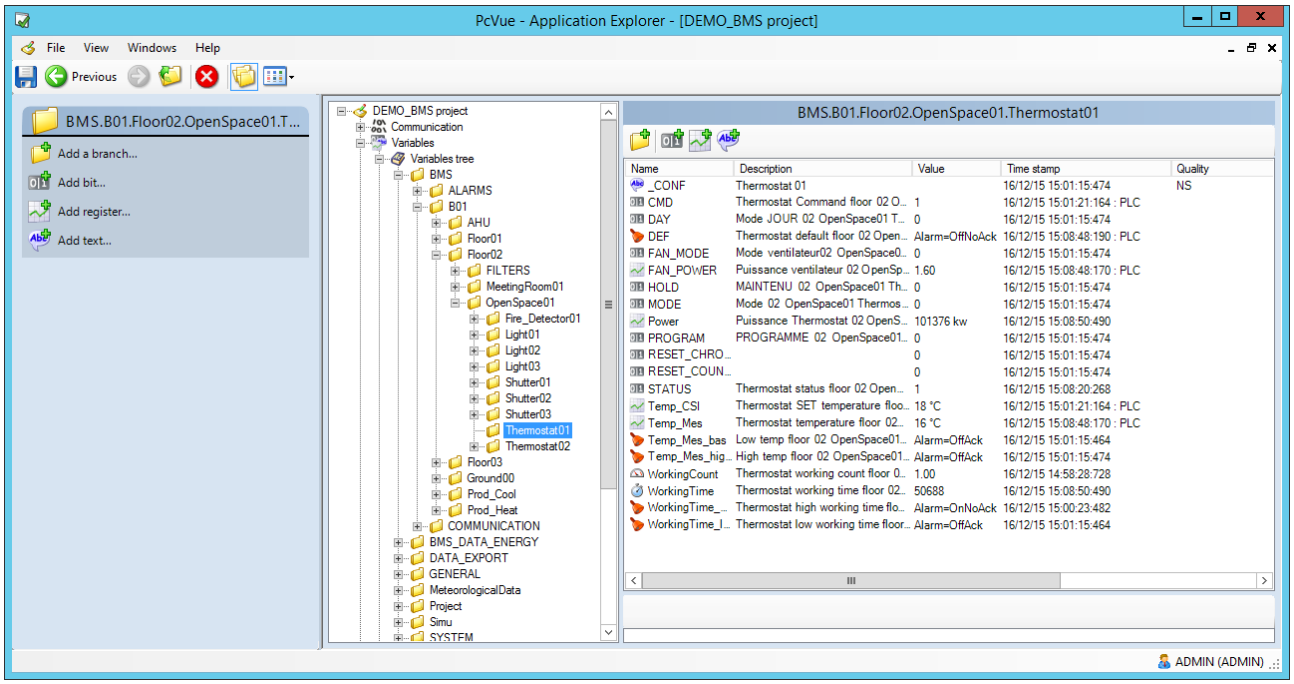


Figure 7 – Variable tree

The Variables Tree is designed so that variables are grouped together in a similar manner to the real world. The groups are similar in concept to a Windows' folder. The folders containing the variables are nested thereby generating the structure of the tree. The complete folder structure that contains a variable is known as its branch. In practice, the term branch can be used to refer to all or part of a branch structure (similar to a tree where a branch is made up of many smaller branches.)
This data structure helps to create projects that are both easy to design and maintain.

8.2 Generic Approach

The branch concept of the variables let the developer easily builds generic objects (graphical symbols, program or mimic) : the same generic object can be re-used in different variables contexts.
When a generic object is created only the leaf of variables names is used without any branch. The branch is supplied each time that the object is instantiated, to 'connect' each leaf of variables of the object to the branch, and animate the corresponding variables.

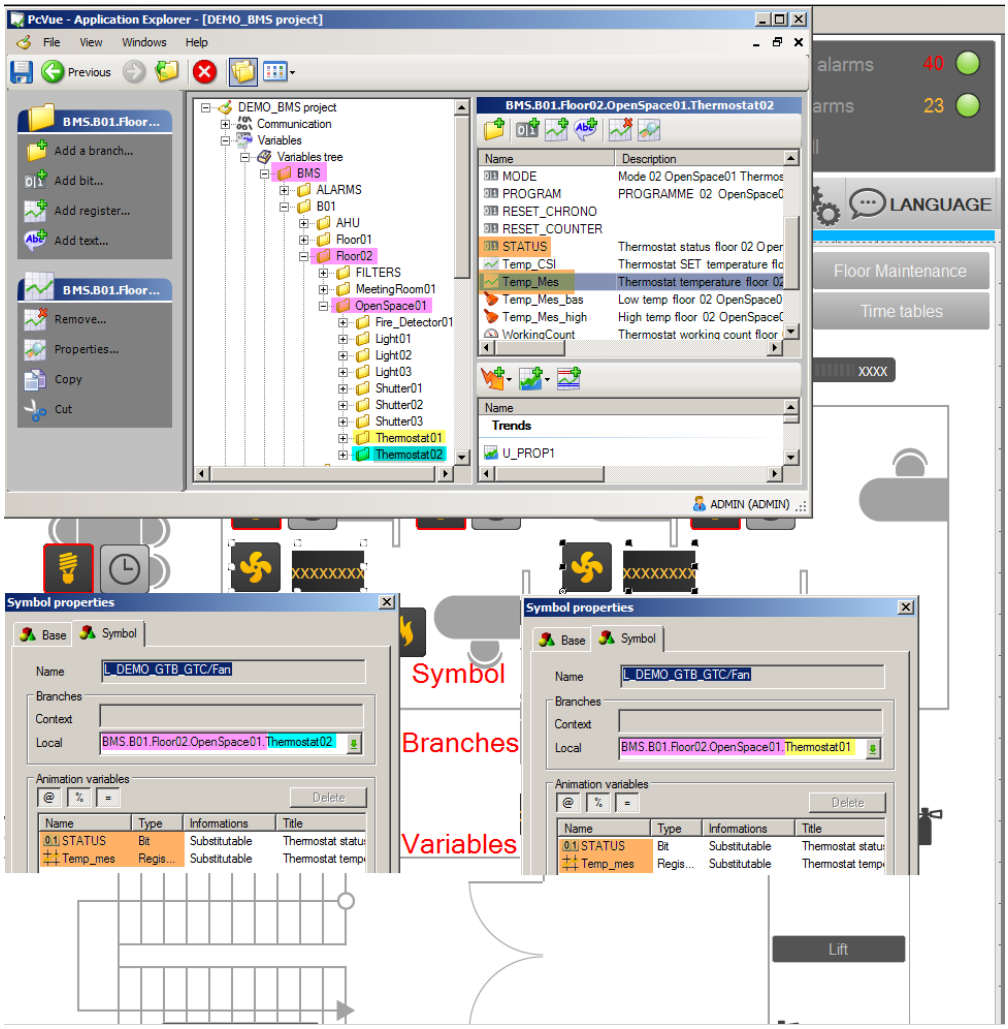


Figure 8 - Data structure and genericity

For example- A symbol represents an air conditioner. The symbol indicates if the air conditioner is on and the ambient temperature. When animating the symbol the variables names are used without a branch:

TEMP_MES

STATUS

The branch is supplied when symbol is inserted into a mimic to 'connect' the variable leaves of the symbol to the branch and the animations to the corresponding variables (Branch+leaves).

The same symbol can be instantiated any number of times with different branches thereby displaying different variables.

This principle is extensively used in PcVue for all kinds of objects (mimics, symbols, programs, expressions) and dramatically reduces the development time particularly for installations composed of highly repetitive elements.

8.3 Data types

The following variable types are supported.

- **Bit** - Logical or two state data
- **Alarm** - A sub-type of bit with modified behavior
- **Register** - Any analogue data (byte, word, double word, float etc.)
- **Text** - String data

A variable could be:

- **An Internal variable** – the data value is calculated in PcVue
- **An Equipment variable** - the data value is given by the communication layer

8.4 VTQ – Value Time Quality

Each variable has three real time properties, value, quality and timestamp - also known as VTQ. The timestamp has millisecond resolution and is the time that the value last changed.
Timestamp can also be provided directly by the PLC by using one of our timestamped protocols.
Any variable can be configured to be shared on multi-station architectures and/or made available for third party software through several interfaces (OPC, webservices,…). In such case the VTQ is broadcast.

8.5 Properties

Variable configuration is rich in properties with all variables having a Description, Source, filters criteria (Domain, Nature), and Command level plus properties specific to each variable type, Maximum, Minimum, Units, Associated Label etc.

8.6 Attributes and Filters

Extended attributes provide the opportunity to associate a number of binary and text attributes with each variable. The single binary attribute takes the form of a 32 bit integer than can be entered either as a number or as 32 individual bits. The text attributes are entered as a string or as the name of another variable. If you use the name of another variable, when that text attribute is referenced, the value of that variable is used.
Up to 16 free format extended text attributes can be configured for each variable.

Extended attributes have many uses such as:

- Cataloguing data for better filtering particularly in the alarm viewer or logging :
- Add details of specific characteristics to a variable. For example you might want to include the name of the equipment manufacturer or a reference that can be displayed on a mimic:

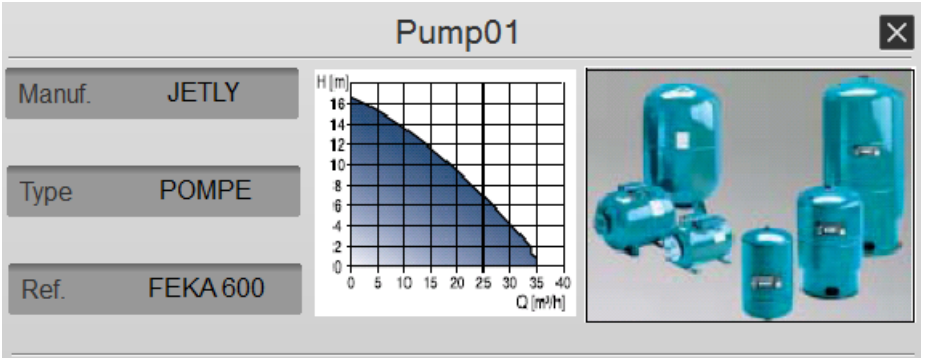


Figure 9 - Example of a detail popup with information displayed from the extended attributes

8.7 Expressions

PcVue has an expression engine for calculating a value using one or more operators (logical or mathematical functions) and variables.
Expressions are calculated automatically when the value of any element changes.
Expressions can be configured in various ways:
- Entering an expression directly in an animation
- Definition of expression model
- Definition of variables whose value is the result of an expression

Examples of expressions:
Motor01.Stop & Motor01.Start | Motor01.Fault
(Valve.Flow01+ Valve.Flow02) / 100
Tank01.Temp & 65520 (mask the first 4 states of value)
EXP (LOG (Valve.Pressure.Value) / 2) (Calculates the square root)

9. Operators interface – HMI

All displays will be in full graphics mode. Operator actions will be carried out via any pointing device recognized by the operating system (mouse, trackball, touch screen, optical pen, etc.) and / or by the keyboard.

9.1 Design

PcVue will have its own graphic editor which will exploit the latest vector drawing technologies in order to offer maximum productivity when creating mimics.
PcVue will have tools to help with editing and graphic design:
- A drawing properties manager allowing more controls over how properties are applied to drawing elements, both individually and in multiple selection. It will also allow copying the properties of one element to other elements.
- A graphic explorer allowing to have a hierarchical view at a glance of the constituent elements of a synoptic, and also to modify them.

Thanks to object-oriented technology, graphic objects will be easily created and reusable without specific development. Any change to any object will automatically propagate wherever it is used, reducing the risk of errors and making it easier to maintain the application.

9.1.1 Template project

The supervisor will have the functionality to create the main framework of a project in a few clicks.
A configuration wizard will allow the creation of a project in stages, in particular:
- Choose the style and ergonomics of the project
- Choose the most suitable resolution
- Create menus

It will be possible to generate a "ready-to-use" project including the following pre-configured elements:
- A view of trend curves
- An archiving configuration and an event logging view
- A view of pre-configured alarms and alarm counters
- Pre-configured user accounts
- Examples of programs

Several ergonomics and styles will be available:
• 5 styles
• 2 theme: light / dark
• 4 colors of exergue

• 4 resolutions

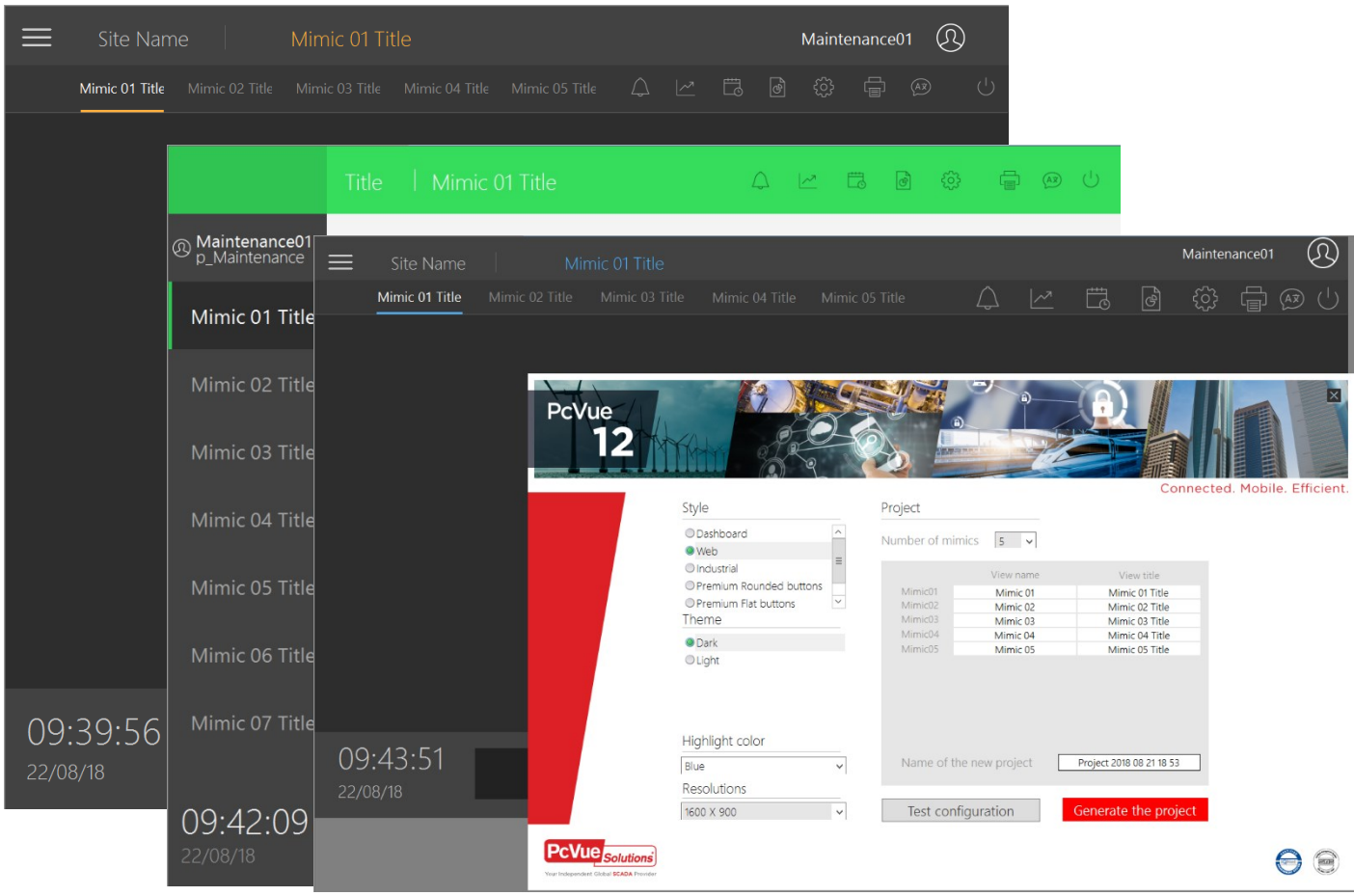


Figure 10 - Example of a detail popup with information displayed from the extended attributes

9.2 2D & 3D mimics

PcVue includes an editor allowing to build the synoptics. This editor will have tools for drawing, formatting, arrangement ...
A management of the mimics in 3D mode, via DirectX objects, will be necessary because it will allow the creation of mimics representing the buildings in the most realistic way possible. It is important to note that 3D objects will benefit from the same animation possibilities as 2D objects.

9.3 Librairies and generic objects

As standard, PcVue will be supplied with libraries of simple objects (drawings, icons, standardized symbols, etc.) and objects integrating ready-to-use animation behaviors:
-Images
- Animated symbols
- Object models
In particular, it should include the following libraries:

- HVAC
- Building
- Pumps
- Engines
- Electric
- System
- Sensors
- Orders
- Navigation

The user will be able to modify or add online objects in the libraries with the standard tools of the editor, without programming and without external compilation.
During the design phase, it will be possible to create and manage custom object and symbol libraries in order to use them in different projects.

The HMI must respect the concept of a contextual object which allows an object to obtain the contextual data of another object.
For example, it will be possible to define a mother / child relationship between two screens. In this case, the child window inherits the context of the parent screen.
This functionality combined with the structured organization of data will allow easy development of contextual pop-up views such as detail views.

In the example below, the detailed synoptic of the thermostat is unique. It is used with different contextual data depending on the symbol of the thermostat from which it is opened. In addition, the tooltip automatically retrieves the context of the associated symbol to display the description of the device.

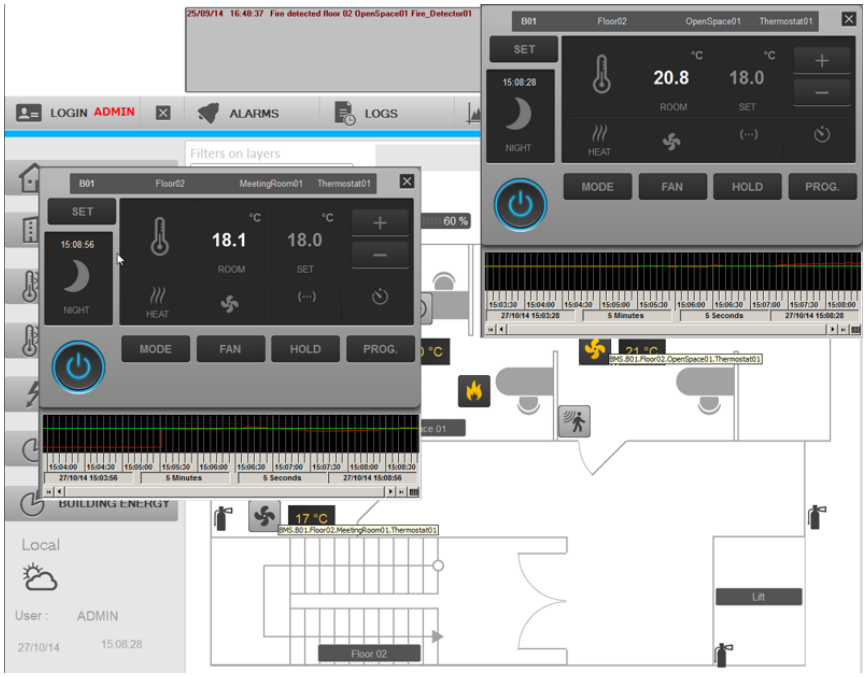


Figure 11 – Contextual popup

The same principle can be applied to other objects such as symbols, programs, contextual help bubbles, ...

Groups of animated graphic objects can be created and saved in the form of generic symbols, that is to say infinitely instantiable for different real-time data contexts.
Any modification of a symbol will be automatically applied to all its instances in the application.

In addition, these libraries associated with a modeling tool will allow the creation of models of sets (lighting, floor, offices, detectors, etc.) to facilitate changes linked to the development of the building.

9.4 Animations

All the information contained in the real-time database of the supervision software (Logics, Analogues, Texts, Date / time) can be used on the graphic mimics. Depending on the animations used, this information will be directly accessible on the mimic in read-only or read / write.

The type of animation will determine the type of display: in the form of text, colors, graphs (bar graphs), appearance of symbols, moving objects, lists of variables, etc.

PcVue will have at least sixty basic animation behaviors as standard which can be combined to obtain complex behaviors (multi-criteria animation) including:
- color change
- the visibility
- text display
- movement
- the rotation
- sizing
-...

9.5 Trends viewers

PcVue has built-in components for displaying trends of real-time data or archived data

9.5.1 Trend viewer for Real-time and Historical Data Trends

- Built-in control that can be embedded in any mimic
- Up to 100 traces per viewer
- Same user interface for both real-time and historical trends which can be displayed simultaneously

- Highly customizable interface
- Fully customizable legend to display properties, and/or dynamically hide/show traces, scales, change color, set thresholds display,…in run time
- An easy to use calendar to search and display a specific period for a trend window.
- Multiple zoom capability
- A simple wizard to export trend data to Excel at run-time including statistics
- Thresholds display
- …

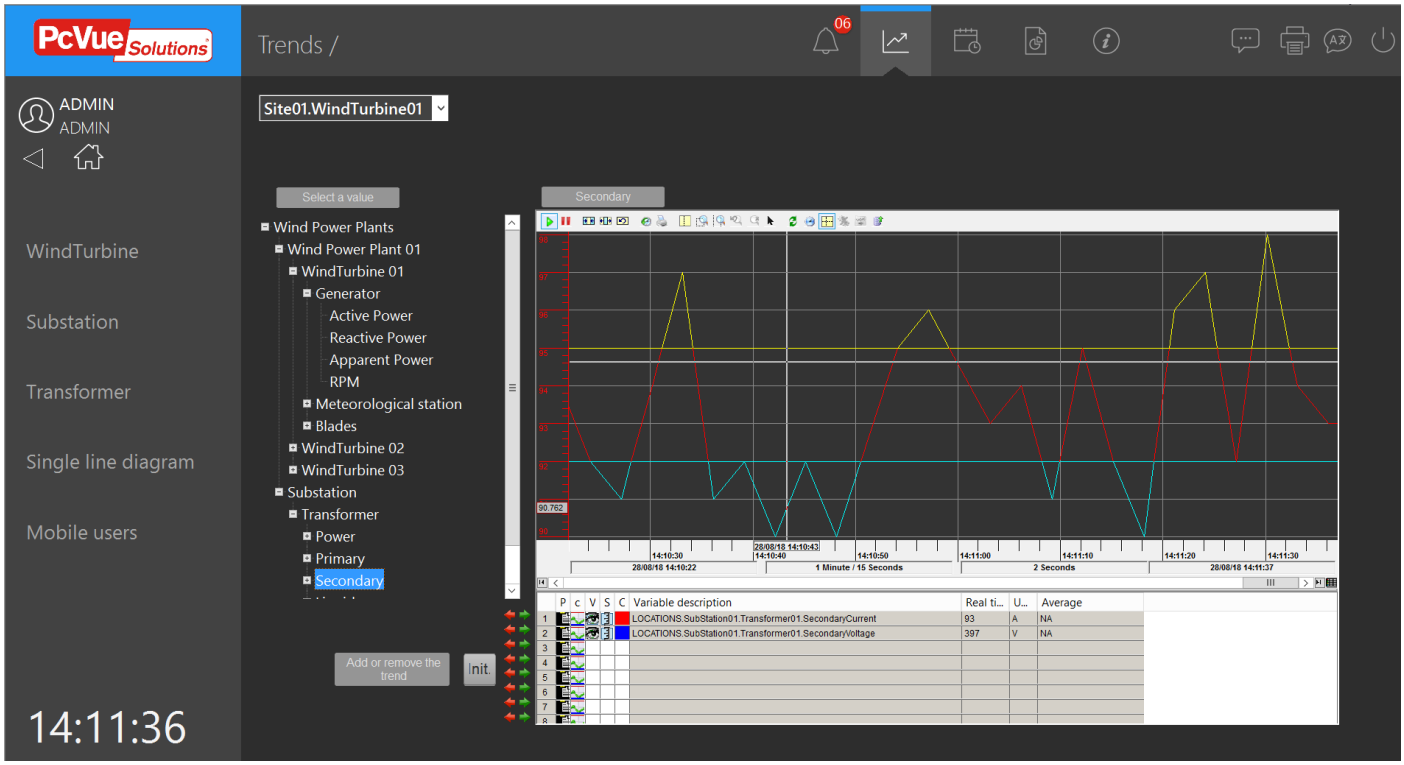


Figure 12 - Example of a Trend Viewer

9.5.2 Chart Control for Y=f(X) Trends

- Built-in control that can be embedded in any mimic
- Plots data series : values variables (Y-Axis) against one other (X-Axis)
- Up to 8 series each representing a register or a bit
- Draw types : lines, columns, cylinders, points,…
- Graphical features : Legend, zoom, cursor, tooltip ,print, popup on right-click,…
- Reference series (lines, or ranges) for comparison (business oriented series)
- Chart control is not supported on web client and web app

9.5.3 Charts

Supported charts

- ✓ Doughnut,
- ✓ Pie,
- ✓ Pyramid

Supported Run time features

- ✓ Value format,
- ✓ Collection,
- ✓ Explode,
- ✓ Skins,
- ✓ Colors,
- ✓ Populate,
- ✓ 2D/3D,
- ✓ Save,
- ✓ Print,…

9.6 Mimic Navigator

The Mimic Navigator is an alternative method of scrolling a mimic that is larger than its container window - when the mimic has been zoomed for example. It's a built-in tool available at both design and run-time.

The Mimic Navigator is displayed as a thumbnail of the mimic with a black rectangle representing the current view. The rectangle can be dragged with the cursor changing the view of the mimic as it moves

This feature is very useful to help user to navigate through a very large process such as a building floor or a electrical busbar.

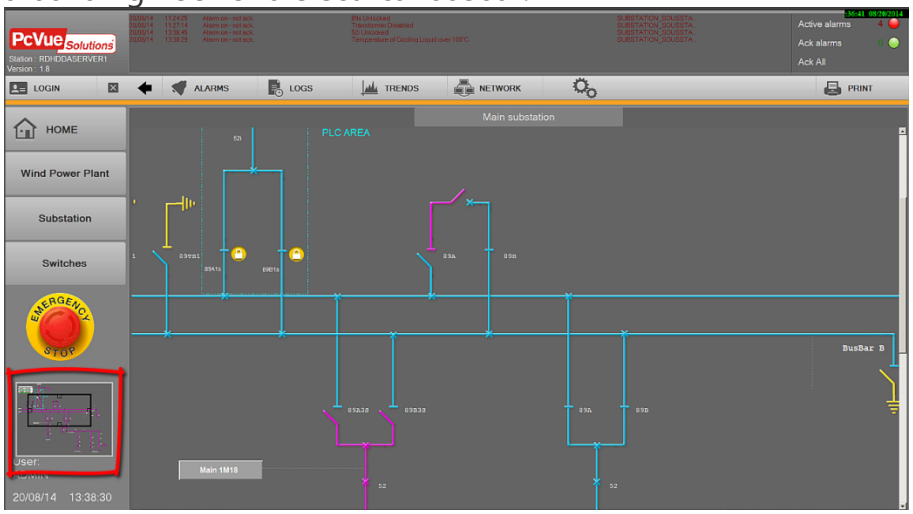


Figure 13 - Example of a mimic using a navigator panel

9.7 Mimic tab control

The mimic tab control is a built-in feature which enables you to define multiple pages in a mimic which, at run time, are selected by tabs in a similar way to some configuration dialogs.
The look and feel of the tab control is inherited from the Windows appearance configuration.
The mimics displayed in a tab have the same properties as regular mimics.

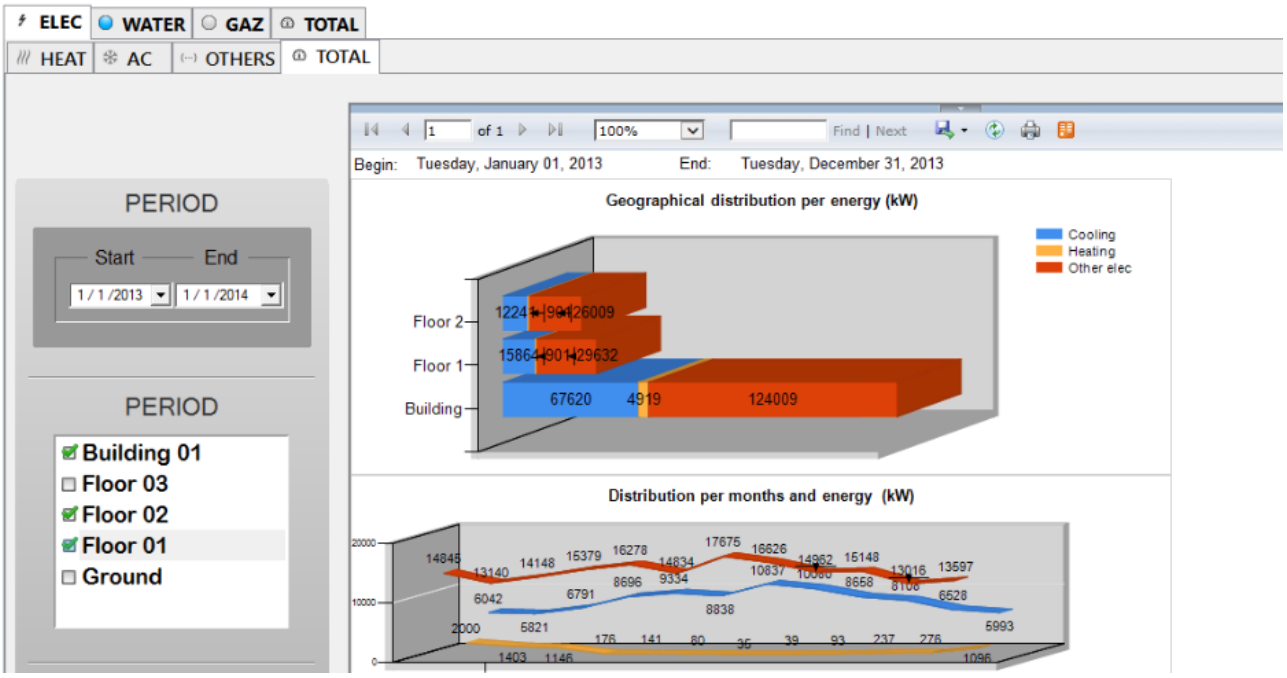
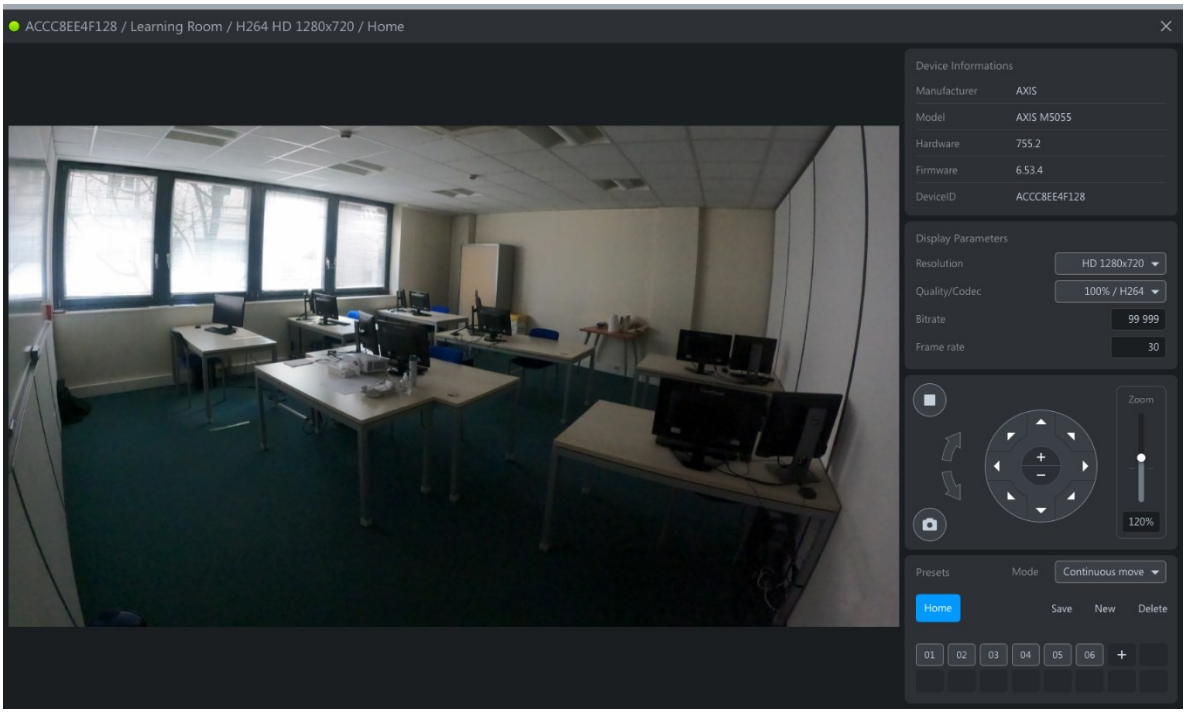


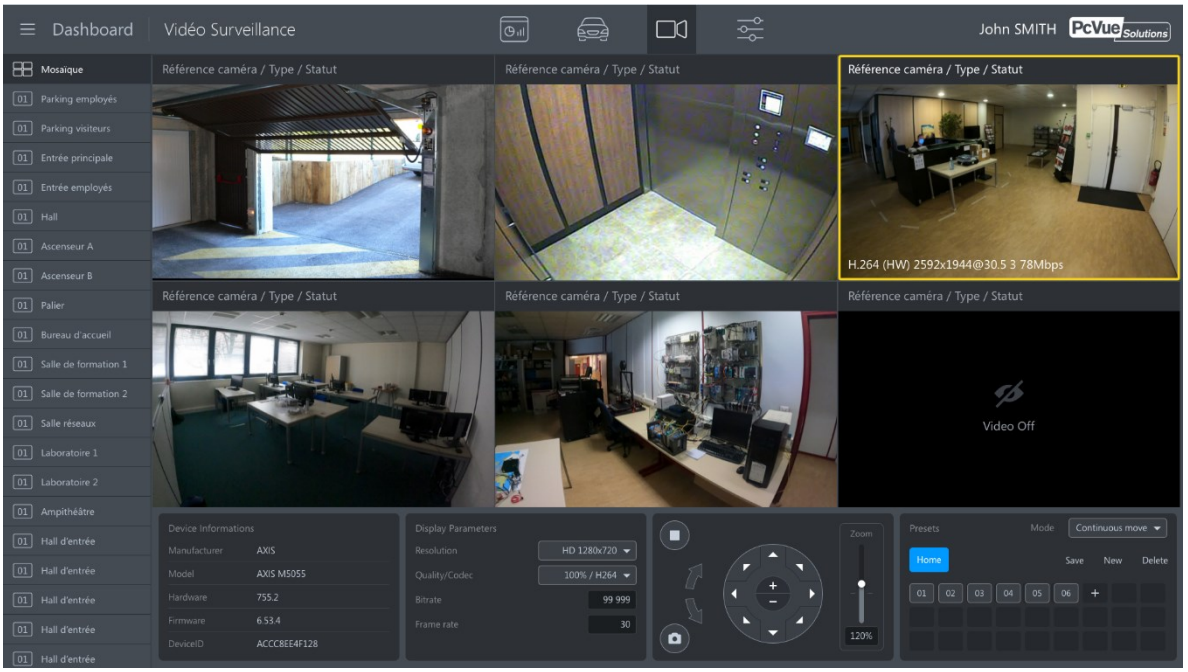
Figure 14 - Example of a mimic using tabs

9.8 Video

PcVue allows the integration of video streams, notably with the ONVIF driver.
In most cases, the management of video streams is carried out in PcVue thanks to the integration of ActiveX offered by video manufacturers.
The flexibility of the PcVue offer then makes it possible to use these streams and control the video system using PcVue's configurable scripts.
The operating and administration functions are generally as follows:
- the use of the main functions of the video
- administration and configuration of video equipment such as cameras, encoders, recorders

According to the need it is possible to manage in display in PcVue one or more videos simultaneously.





• Operator actions for real-time video management

From a PcVue station, the operator can, depending on his rights:
- Select a camera to display it on a video wall monitor
- Assign and control a cycle on a monitor.
- Select the different prepositions of mobile cameras,
- Control the manual positioning of mobile cameras (Azimuth, Orientation and Zoom).

• Automatic actions without operator processing

When a configured alarm appears (example: Break-in ticket dispenser), triggers automatically switch the image from the camera associated with the alarm to the monitor dedicated to the alarm display. .

• Other possible actions for the operator

- Selection aid by previewing on a cartographic synoptic the zone covered by the cameras according to these prepositions.
- Control of camera prepositions on a particular element
- Automatic selection of a set of cameras viewing a selected area.

9.9 MAP control

The PcVue map control is a built-in PcVue component client for a GIS mapping service which:

- Displays an interactive map provided by map providers. Online & offline both supported
- Allows an easy map manipulation with integrated functions such as panning and zooming
- Displays overlays with custom dynamic objects (Markers) including PcVue animated symbols
- Not supported on web or mobile clients

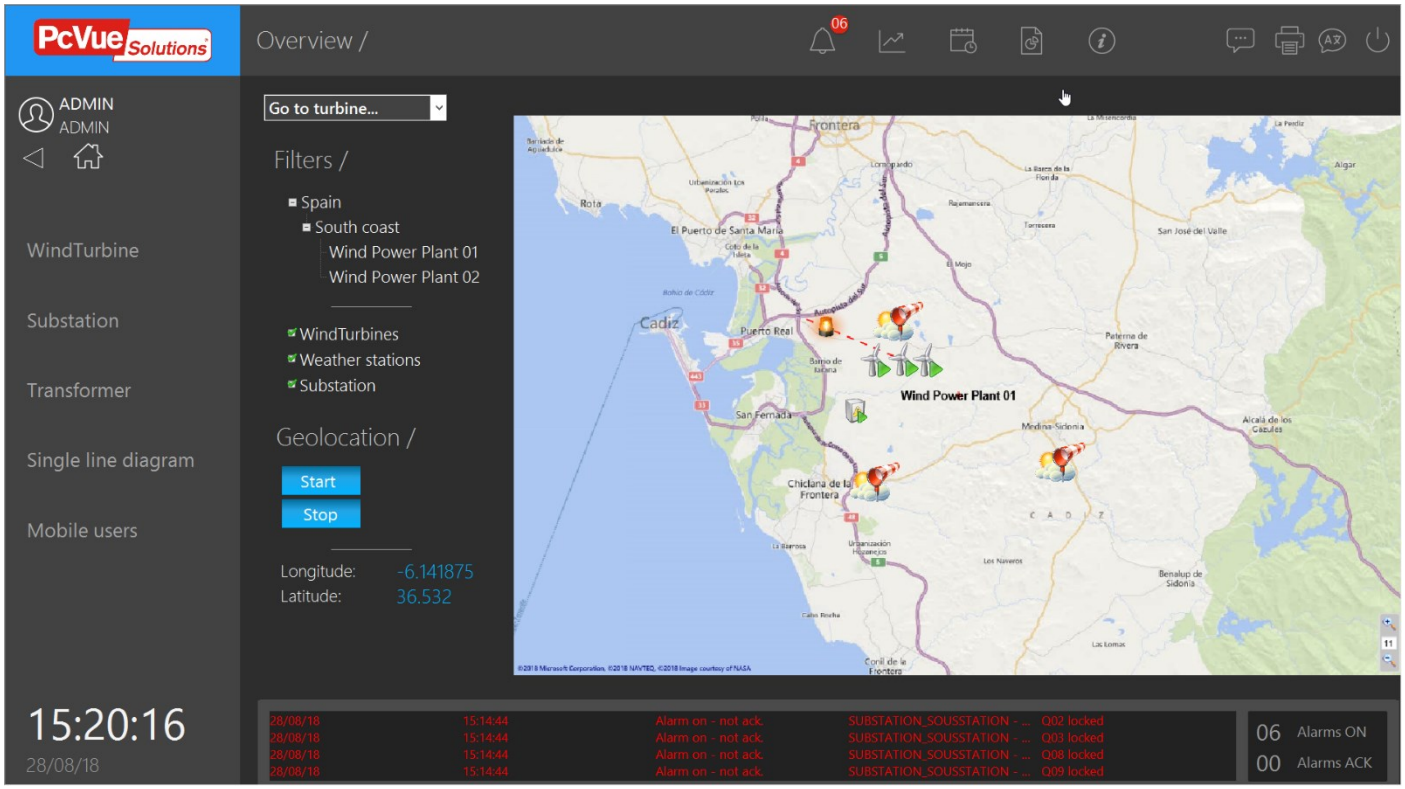
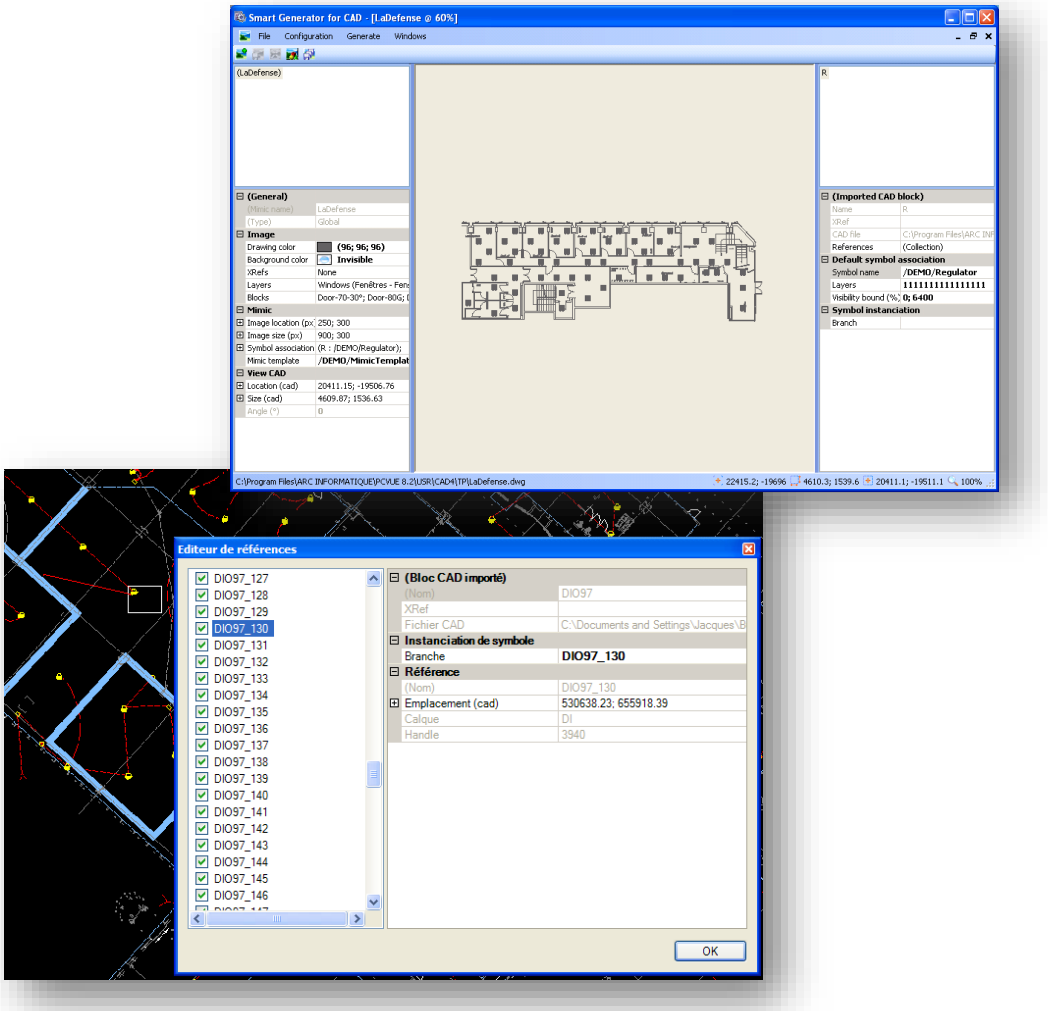


Figure 15 - Mimic embedding a Map Control

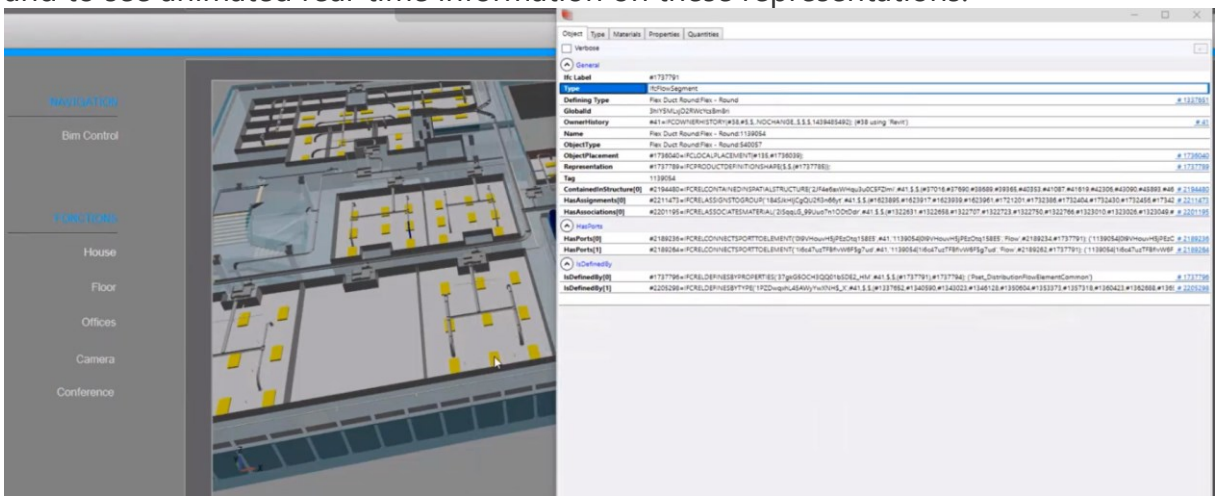
9.10 AutoCAD

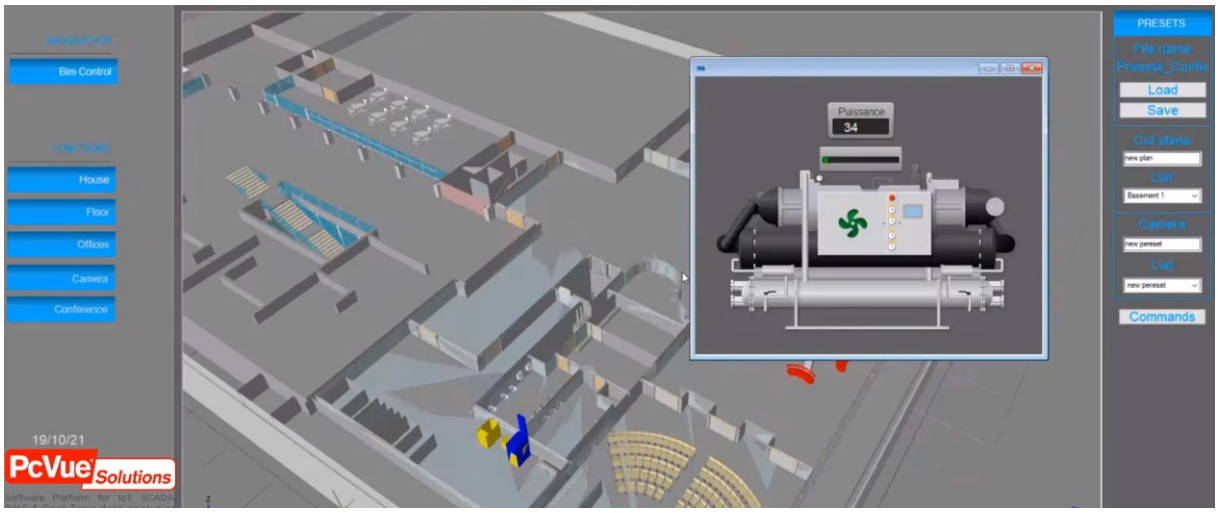
The Smart Generator import tool is used to automatically create mimics integrating Autocad diagrams by importing files in dwg or dxf format.
The import tool will allow the following functions:
- Size and position of the image in the synoptic
- Scroll
- Zoom
- Trimming
- Rotation
- Modification of the drawing color
- Modification of the background color
- Selection of layers
- Selection of blocks
- Substitution of the blocks of the CAD file by symbols from the supervision software: when generating the mimics, each block reference is replaced by the chosen symbol. The symbol is positioned on the image at the location of the block reference.



9.11 BIM

PcVue can be connected to BIM and retrieve the various associated elements by importing an IFC file.
It is then possible to visualize on a 3D view the elements of the building nomenclatures and to see animated real-time information on these representations.





9.12 Zoom and layers

The Standard zoom capabilities are supported (Zoom IN, Zoom OUT, Zoom Area) as well as de-cluttering which hides and displays graphic objects according to zoom level. It's also possible to define de-cluttering templates which enable the display of layers according to zoom level.
This feature is very useful in run-time in order to automatically reduce the amount of information visible so that the most important information is readily seen.

The HMI supports a CAD-like layer system for drawing. Any graphic objects can be allocated to one or more layers. Thus, in run time, the user can easily display or hide graphic objects by enabling or disabling layers on which they are allocated. The layers levels can also be associated with user profiles so the graphic objects are automatically displayed or hidden depending on the current user.

9.13 Multi-screens

PcVue provides built-in management of multi-screen displays and video walls. By having multi-screen, an operator can have access to several aspects of the process simultaneously (mimics, alarms, ...). Sharing or comparing data between different parts of a process is much smoother.

10. Alarms managemennt

PcVue must be able to alert the user to any malfunctions of the installation, to allow alarms to be taken into account and to ensure follow-up.

10.1 Alarms processing

In PcVue an alarm is generated by a bit variable that has been configured with alarm behavior. This means that alarms have all the flexibility associated with a bit plus the characteristics required by an alarm. Changes in alarm value are time-stamped to millisecond resolution. The origin of the time-stamp can be PcVue itself or the source of the value (PLC, OPC etc.).
A real-time alarm list is provided by the Alarm Viewer. Alarms can also be used in the HMI's animations the same as any other variable to produce color changes, change text strings, exchange symbols etc. Individual alarms can be accepted by an operator with the corresponding user rights. Advanced group alarm acceptance strategies can be configured using SCADA Basic.
In distributed applications alarms are broadcast to all nodes. Alarm acceptance (subject to user rights) can take place on any station.

10.2 Alarm visualization

Animations:
The alarms can be used with any state type animation, but they will have specific animations (colors, texts, symbols ...) allowing to integrate the notion of acknowledgment state. The colors, texts and flashing will be fully customizable for each type of priority.

Alarm lists:
PcVue must be able to display lists of real-time alarms in one or more synoptics.
For example, a list can be displayed in the form of a banner on each screen, but also in a dedicated screen.
Each alarm list will be customizable.
In this list each alarm will be displayed on a single line in a configurable color identifying its status and priority level. The list of alarms can be sorted by priority, by age with the most recent displayed at the top or bottom of the list.
The information displayed for each alarm must be configurable:
• Name, description,
• Domain (Building, Floor, etc.)
• Nature (CTA, ELEC, etc.)
• Priority
• Status including inhibited, masked and maintenance mode
• Present, absent, acknowledged ... with the time stamp in a configurable format
• The value and type (high level, low level, etc.) for alarms produced by the behavior of a threshold of a measurement variable
• Up to 8 configurable extended attributes including the value of other variables
• Display on the same line of the time stamp of the appearance of an alarm, its acknowledgment and its disappearance

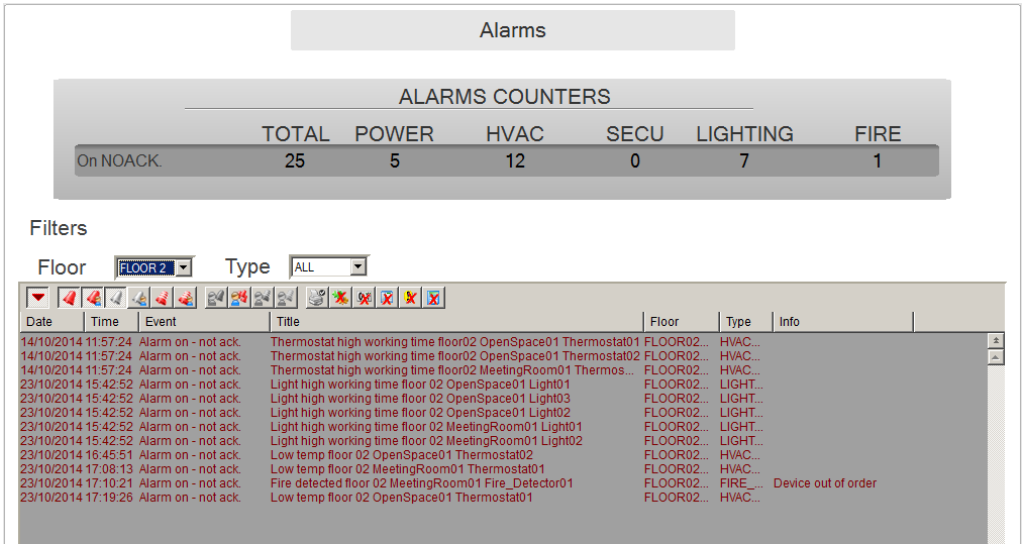


Figure 16 - Exemple d'une vue d'alarme

The alarm list can be configured to display a pop-up pop-up by clicking on the alarm, displaying any property associated with the alarm.
In addition, several contextual actions can be performed defined and customizable such as:

- Open a synoptic associated with the alarm
- Add a predefined message or write a comment before acknowledgment
- Open a follow-up file associated with the alarm for editing or saving
- Open a procedure or a technical note (pdf, word, Excel, etc.) required by the operator
- …

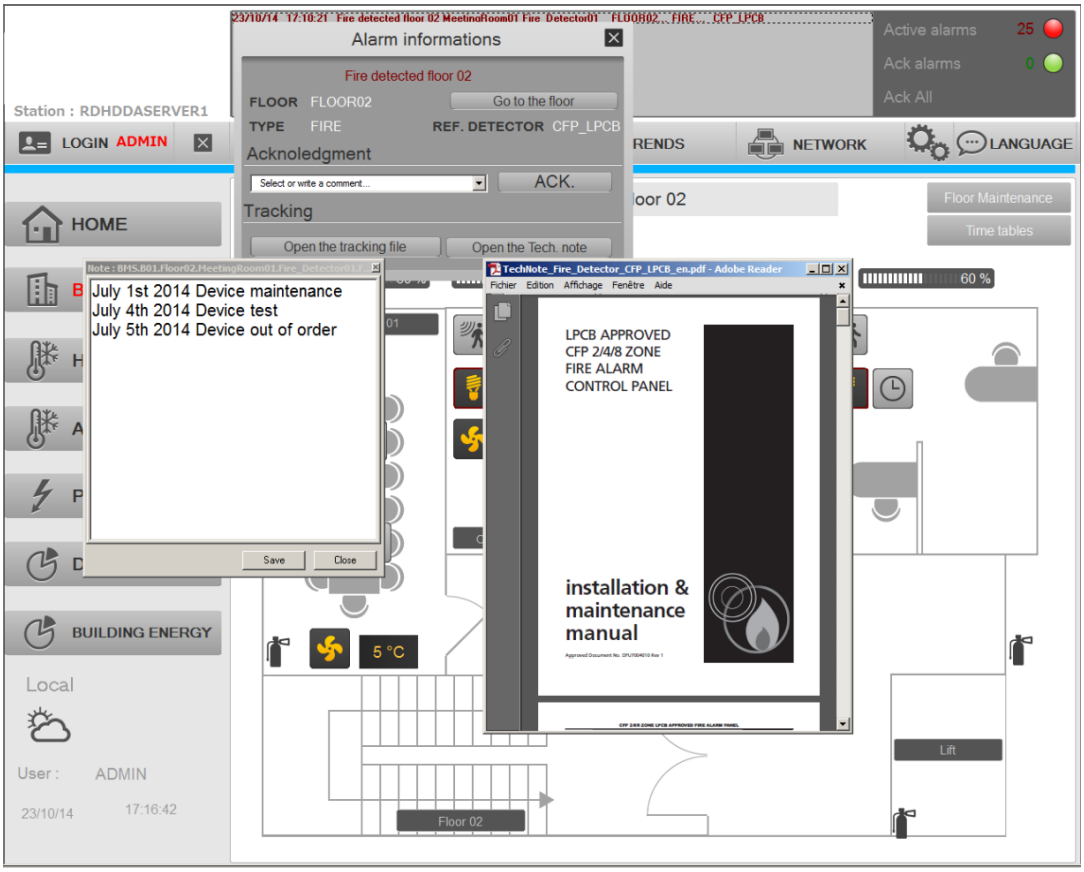
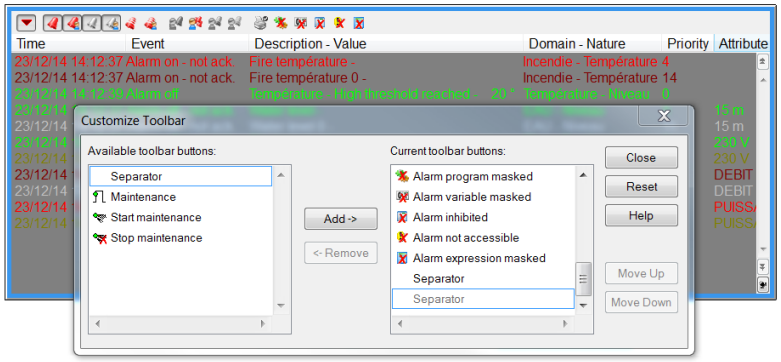


Figure 17 – Alarm pop-up

Pilotage by the Operator

Each alarm window will include a configurable toolbar from which the operator can display and change the alarm window filter, acknowledge, inhibit or switch alarms to maintenance mode, and perform an associated action on a particular alarm. (for example open a mimic linked to the original alarm).



Consultation filters:
The display of alarms in a list will have a filter function, giving users the choice to select among others:

- the types of alarms (present acknowledged, unacknowledged, etc.)
- the degree of urgency (30 priority levels)
- the location and nature of the fault

Action associated with an alarm label:
From the list of alarms, the user can select one of the alarms and will have associated actions on the right click (management of causes of shutdowns associated with the type of fault selected for example)

Access filter by station:
It will be possible to define a display filter and alarm processing according to the workstation (PC) on which the operator will work

Summary of fault:
PcVue will make it possible to create fault summaries which will indicate in real time the number of faults corresponding to a filter defined by the user (by expression, professions, geographic locations, criticality or other criteria).

These summaries can be viewed in the synoptics of the supervision and trigger actions (such as sending an e-mail or generating an audible alarm) in the same way as any other variable

11. On-call

11.1 Emails and sms

Any supervision event such as the appearance of an alarm, threshold violation, etc. may be the subject of an SMS and / or email.
To do this, PcVue will natively integrate SMS and email management which is very easy to implement:

- Automatic sending of messages on appearance of an alarm, event or any other configured action
- Integrated peripheral configuration
- Definition of priority levels
- Possibility of developing message templates containing fixed or modifiable parameters as well as substitution characters linked to the application (value of one or more variables when the message is sent)
- List of predefined recipients configurable

11.2 On call

In addition to the alarm reporting functions, on-call management will be provided.
For this, third-party software may be used provided it is fully compatible with the management of alarms from the supervision system.

Upon activation of an alarm, the on-call management software will trigger the execution of a list of associated actions. Actions can also be triggered when returning to the normal state or acknowledging an alarm.

On-call operators, not present in front of their supervision station, will be notified of the arrival of an alarm via numerous media:
• Telephone (landline or mobile): operators are called by telephone, listen to alarms and acknowledge them using the integrated voice server.
• SMS to alert, via mobile phone or pager, operators working off-site.
• Dedicated pager systems to quickly alert maintenance operators working on site.
• Fax, remote printer and email to receive written reports on detected alarms and their contexts.
• Internet browser or WAP mobile phone.

All current technologies will be supported: analog, digital (ISDN), voice over IP, radio (talkie / walkie) DECT, paging, etc.

11.2.1 Operators management

It will be possible to create operator profiles defining a specific working environment for each category of operators (menu, toolbar, displayable screens) as well as a set of authorized commands (acknowledgment, configuration of on-call duty, supervision, system parameters, etc.).

Each operator defined in the on-call management software will be attached a list of call numbers allowing him to be reached (telephone, SMS, pager, fax, email, etc.). The calls will be made in the order of the list, until a call is considered successful.
Calling different media for the same operator (SMS + telephone for example) will be possible. The composition and the order of the list can be dynamically modified from the weekly schedule of the operator's call numbers. When an operator is temporarily unavailable (illness, travel, vacation, etc.) he can be taken out of service, and possibly replaced, either manually or automatically from his service schedule.

An operator can also be defined as a virtual operator to designate a call media that can be shared by several operators (laptop or pager). The call of a virtual operator can be acknowledged by any operator belonging to the same on-call group, for the identification and traceability of the operator who actually handled the call.

11.2.2 On-call teams

An on-call group designates all the operators likely to be called upon to intervene to deal with a category of alarms. In each group, teams will be formed designating an operator or a list of operators to be called simultaneously or by rotation, with the possibility of fallback operators in the event of failure, in accordance with configurable conditions. An on-call group may be designated as a fallback to another group. This group will only be called as a replacement for the main group if there is no one on call in the main group or if the call cycle of the on-call team in the main group has failed.

11.2.3 Scheduling operators teams

Each on-call group may have its own schedule which will define the assignment of the group's teams over one year in hourly, 1/2 hour or 1/4 hour intervals. The schedule will be graphically configurable.
A weekly on-call program can be predefined (with management of public holidays) for the automatic assignment of teams in the schedule.
At any time, it will be possible to deviate from the schedule of an on-call group. When a group is in a derogation state, calls that concern it are suspended or redirected to a derogation team for the group.

For traceability purposes, on-call calls and their possible acknowledgments made by operators may also be recorded.

12. Spaces management

The interior spaces of the buildings will be fitted out according to the tenant lots.
They will also be liable to change over time and with their use, for example during the reorganization of the premises. PcVue will be able to adapt without having to recreate the entire application.

PcVue will have a tool for modeling the application in the design phase.
It will make it possible to create and integrate (instantiate) in the supervision application models of sets of objects corresponding to the elements of the building (offices, thermostat, lighting, detectors, etc.). These models will include all the configuration elements of the assemblies (graphics, communication, calculations, archiving, variables, etc.)

These sets can be modified during the life of the project and the application can be synchronized to apply the modifications.Thus, the new layout of a floor can be taken into account by simply updating the project using the modeling tool.

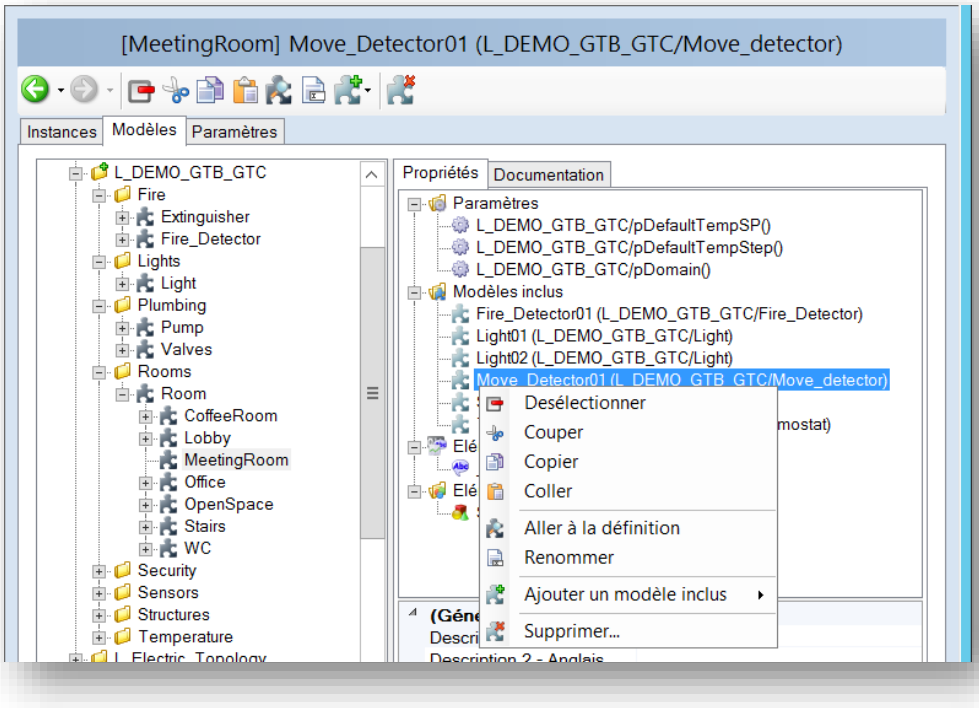


Figure 18 –Modeling tool

In addition to the modeling tool and depending on the field network used, PcVue will integrate the dynamic reassignment of communication objects performed by the field network administration tool.

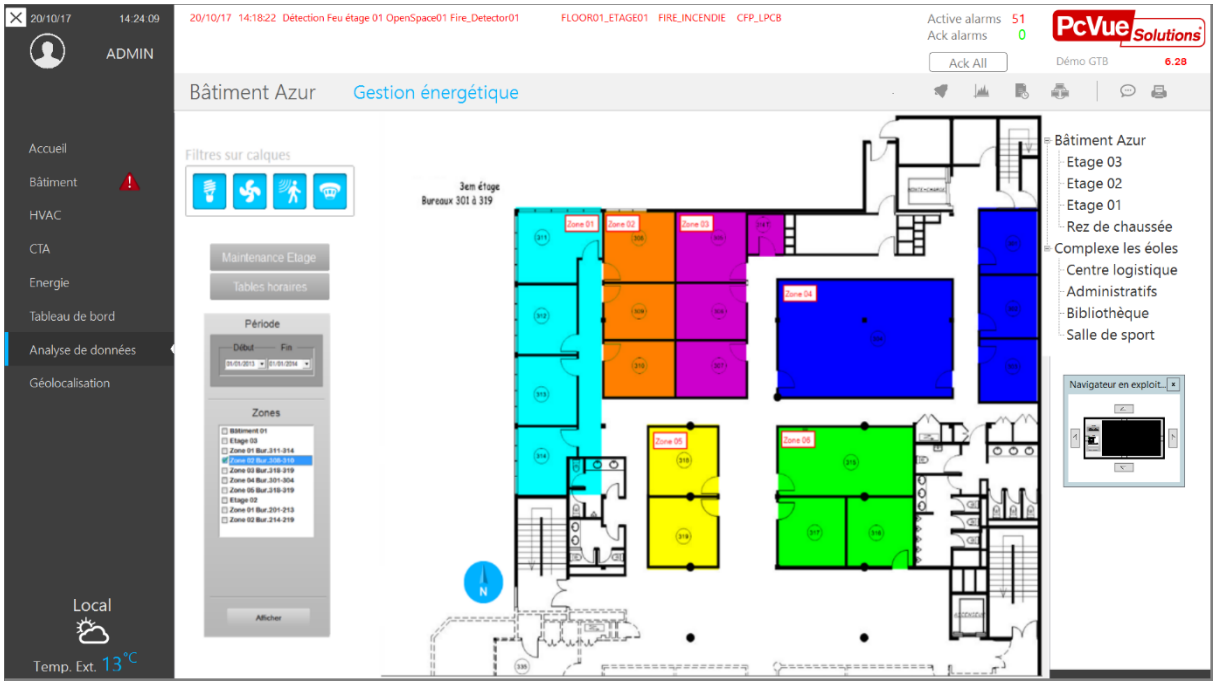


Figure 19 – Spaces management

13. Archiving

The data will be saved on hard disk in Archiving Units, or on paper using a printer.

Ideally three forms of archiving units will be supported:
- Proprietary: the data is saved in a format specific to the supervision software
- Free: the data is saved in a format that can be customized by the user
- Database: the data is saved in a SQLServer database

In order to provide maximum openness in the project environment, PcVue must be able to perform database historizations using a SQL Server compatible DBMS engine from Microsoft.
These possibilities will be adapted to produce long-term histories of data subsequently used mainly in third-party applications.
PcVue must offer event-based historization of trends and consignments or cyclical (synchronized) for trends only. It will manage historical data by leveraging Microsoft's ADO components.
The SQL-type database logging module will be able to log in parallel in several tables belonging to several databases. In order to optimize disk space, certain properties that do not change with each change in the value of a variable (such as its description) will be saved in so-called "static" tables. These properties are only stored once and not at each event.

The Database can be local on the same station or remote through the network. The choice of the different items or attributes of the variables to be logged, apart from those which are mandatory, will be fully configurable.

Redundant history management on SQL Server will be required as well as a built-in function allowing database reconsolidation when one of the two redundant servers is shut down.

It should also be possible:
- manage database maintenance tasks from PcVue
- view information relating to the database (status, size, etc.)

14. Data processing

14.1 Visualization of recorded events

PcVue will have a data logging module concerning events such as alarms, operator actions or changes in values.
It will be possible to define several archiving filters through logging lists of events to be recorded.
The recording of an event will be done with a time stamp with a resolution of 1 ms.

A log window will display the data that has been saved to a particular log list.
The types of data that can be displayed are as follows:
• The alarm changes state
o Present and unacknowledged
o Present and acknowledged
o Absent and unacknowledged
o Absent
o Unavailable
• A state changes status
o Change to zero
o Change to a
o Change to invalid
• Operator actions
o Order
o Connect and disconnect
o Alarm acknowledgment
o Alarm masking

o Program start •

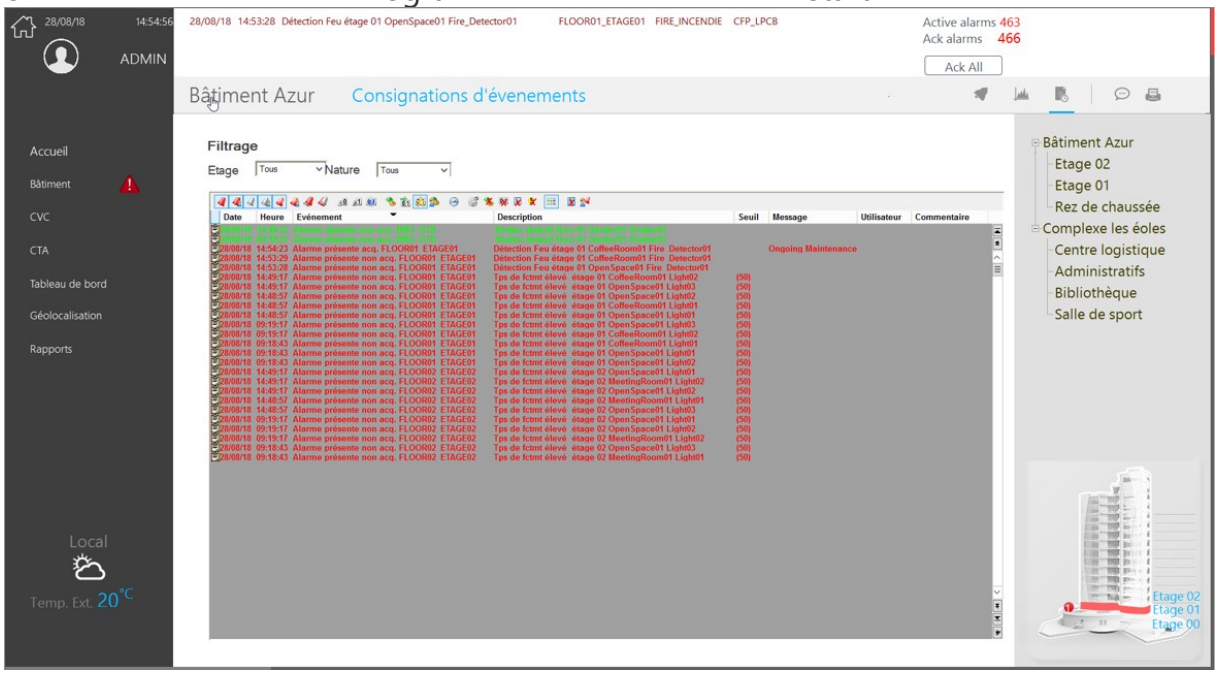


Figure 20 – Log events

Summary of the features of a log window:
• The log window can be integrated into any view
• Unlimited number of log windows in each project
• The size of the log window is configurable from one line to the maximum allowed by the screen resolution
• Data can be filtered by area and nature and / or by time filter to search for records from a specific period (from date and time and a search for management)
• Optional toolbar and scroll bar
• The format of the log lines in the display is fully configurable
• Comment entry - the user is allowed to write a comment of up to 40 characters for each log entry
• Sort modification - the user can change the sort column and direction
• Can be configured so that new logs appear at the bottom or top of the list
• Can be accessed programmatically to customize features
• Can have a completely customizable contextual view during the design phase

14.2 Data processing and reporting

- PcVue will offer all the necessary tools for data extraction, statistical calculations and reporting to allow operators to perfectly analyze and manage their applications in the short, medium or long term.

- For medium and long term analyzes, comparisons, statistics or compliance checks, detailed Excel reports will be generated. A native data export tool will allow the operator, without any programming, to generate statistical data from archives and automatically create reports in Excel and .csv format

- PcVue will also offer advanced reporting functions with the aim of being able to work on complex reports generated periodically and / or events in order to better analyze the existing system.
- These reports must be able to be generated without special programming and without knowledge of the databases.

- The following features are required:
  • Real-time and historical data acquisition from several data sources
  • Real-time data acquisition and alarms
  • Archiving according to time, event or specific conditions
  • Ability to create own reports with logos, headers, footers and custom charts, and to include information in the form of tables and graphs
  • Integration of the most commonly used statistical functions such as: Min, Max, Sum, Average, count, duration… but also the current value
  • Exploitation of the results of statistical functions
  • Creation, modification and saving as a template of an unlimited number of reports
  • Saving of a set of predefined objects in a reusable library at will
  • User rights management
  • Instant generation of reports in PDF or XLS format
  • Generation of reports based on time, on event or on demand
  • Archiving of reports locally or on a server via the network
  • Automatic sending of reports by Email
  • Automatic printing of reports
  • Publication and viewing of reports via a web portal

15. Energy management

PcVue should allow monitoring of consumption and measurements of archived data relating to metering and sub-metering (lighting, water, electricity, gas, hot water, etc.) It will be possible to make statistical calculations from real-time or archived data for energy monitoring.

The restitution of energy monitoring data can be done in different ways:
- Through a summary view in the form of graphs with the possibility of filtering by categories, by date and / or by zones:
- In the form of a personalized dashboard
- In an Excel file generated from PcVue with the possibility of filtering the desired statistical data
- Via a web interface from an internet browser or a web portal

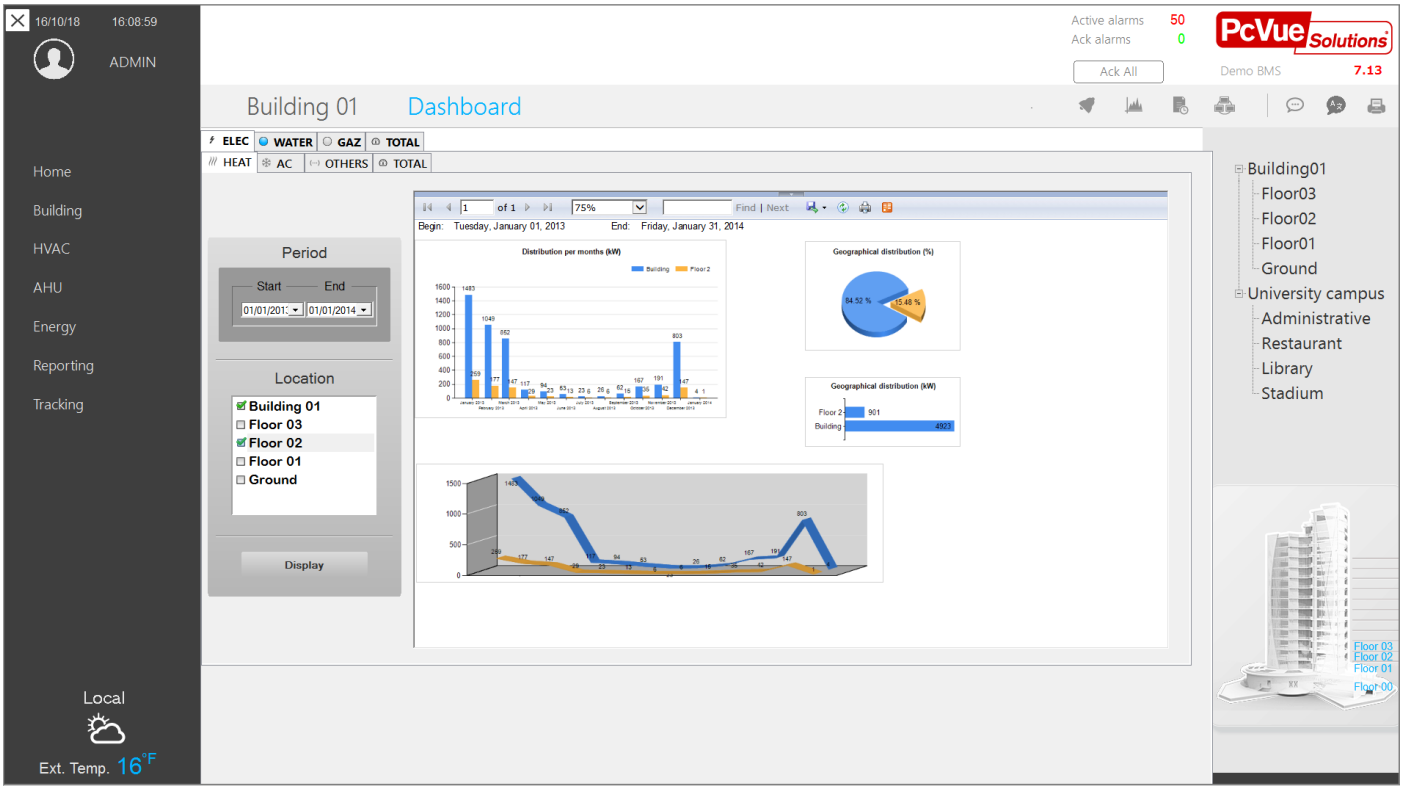


Figure 21 – Energy consumption report

PcVue must also be open and make all real-time or archived data allowing energy monitoring accessible and usable for any third-party system via OPC or webservices for example.

16. Scheduling

A function integrated into the supervision software will allow calendar management of actions that can be linked to the profiles of the workstations or users.
These actions will be carried out on time tables with the possibility of creating exception periods (public holidays, etc.). The operator, at run time, can modify the standard week and / or create exceptions.

A tool supplied as standard with PcVue will allow viewing and controlling all tasks and events scheduled and stored in the system from any device running a web browser.
It will make it possible to plan production cycles, recipes and program routines via Internet / Intranet and it will make it possible to fully integrate new dynamic planning scenarios.
It will also integrate the graphical interface for managing BACnet® calendars.

A user-friendly interface will allow its use not only by maintenance teams but also by operators.

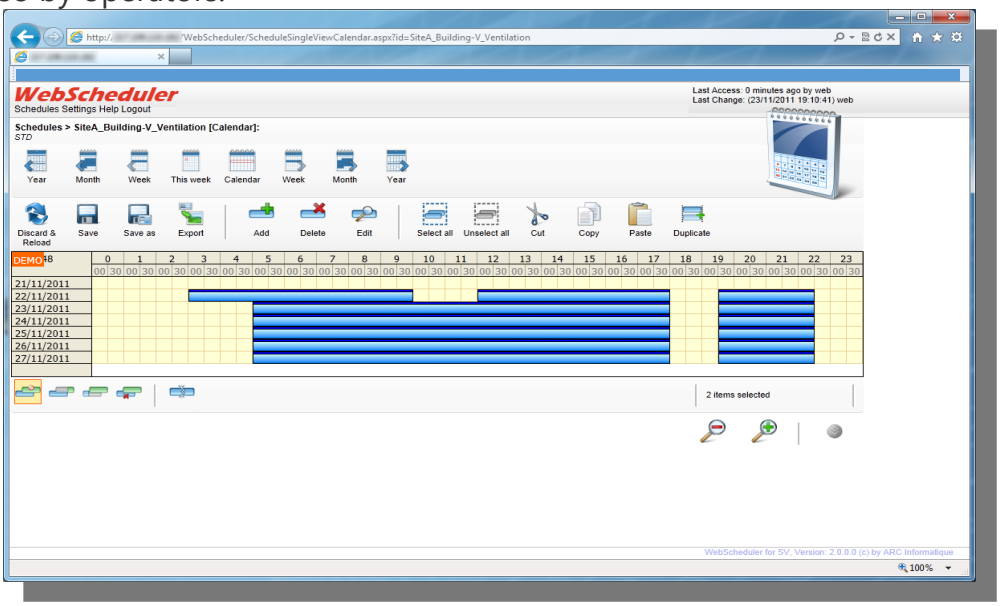


Figure 22 - Scheduler

17. System access and security

17.1 User management

The features of a SCADA application depend on the user rights of the operator who is logged in. An operator will log in to the application by typing his user name and password, specific user rights will then be associated to the user. Unlimited users can be configured but only one user at a time, on a each station, can be connected.
Access rights give operational rights (like access to certain mimics or control rights on a mimic) but also system rights for the PC itself or access to PcVue's configuration tools. Depending on the station where the user is connected their rights can be different.
In order to ease the configuration and maintenance of user rights, a user profile are used, when a new user is created a user profile is associated with this new user. A profile is like a group of users having similar rights.
Main features for user rights are:

- Auto disconnect a user logged in after a customizable time of inactivity.
- Allow to configure a validity period for the passwords.
- Password strength control
- 10 levels of hierarchical profiles
- Facility for locking access to particular mimics, command variables, log variables, acknowledgements and alarm masking of access to various levels of model etc.
- Configuring different access profiles for a user according to the station logged onto, in a multi-station architecture
- Ability to require password change on first login
- Manages a user's "quarantine" after three unsuccessful login attempts
- Integrates user account information encryption

17.2 Cybersecurity

The system will be able to meet cybersecurity constraints with a suitable hardware and software solution allowing:
- Identify vulnerabilities
- Protect the system against intrusions
- Monitor and detect anomalies
- Ensure the maintenance in operational condition and allow the resumption of activity
In order to fully control network flows and equipment on the Ethernet network, it is desirable to have simple but powerful tools for the real-time analysis of IP equipment present on the Ethernet IP network.
The software used may be third party software provided it is fully compatible with PcVue. They will be easy to use, usable by a non-IT specialist and cover all the IP

equipment present in an automated and communicating industrial installation (PC, printers, switches, API, etc.).

17.3 Central project version management

To make the maintenance and the deployment of a project easier and faster, PcVue is delivered with a built-in central project management tool.

Different versions of a project and/or libraries are centralized in a shared directory on the network. The centralized project and/or libraries can be modified from any station on the network.
Usually a dedicated PcVue development station is used to host the central project versions directory and to make the change for a project.
Any station can manually load and run any type or version, or automatically run the reference version of a project and/or libraries from the central project directory. This feature can also be used for stand-alone architecture.

Supported features are:

- 3 version types : development, operational and reference
- Configurable content of a version
- Track modification for each version
- Automatic version numbering system
- Unlimited number of versions (vs media free space)

This device allows to trace the evolution of the project and if necessary be able to return to an earlier version.
In the event, or you want to work in "parallel", the platform allows PcVue through its separate application components (synoptic, communication, BDTR, historical, Scripts, ...) to configure each separately. This requires the establishment of good practices and a coordinator for the aggregation of components before generating a reference version.

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ISO 9001
ISO 14001
certified system

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