CERN Smart Buildings

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on behalf of the CERN SMB-SE group

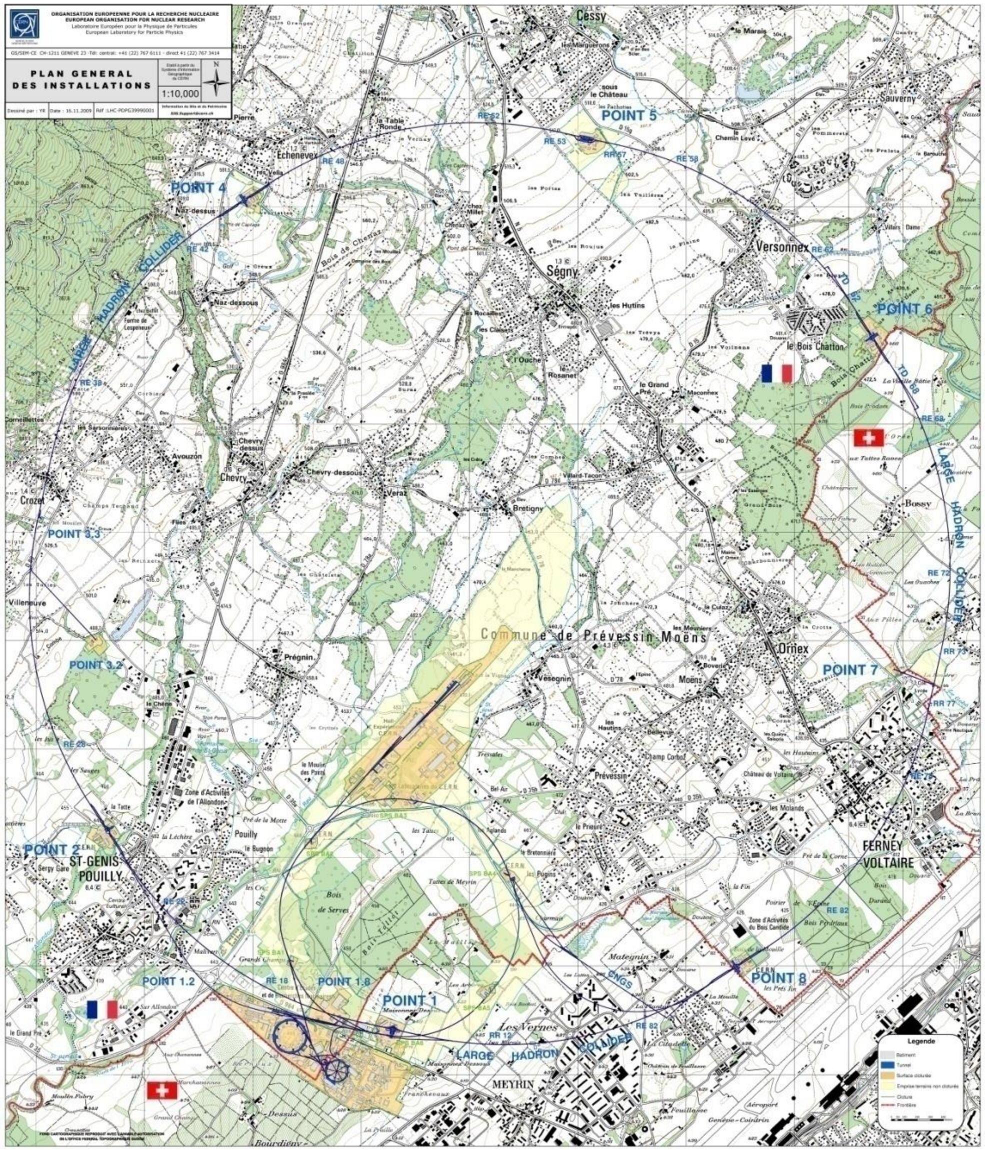
OUTLINE

- CERN Patrimony
- (CERN) SMART building
- Building automation and asset management
- Implementation example

CERN 1954 – Day 1

SMB
Site Management
and Buildings

CERN today - key figures



GENERAL LAYOUT

Two main sites :
Meyrin (CH-FR) : 80 hect.
Prévessin (FR) : 83 hect
15 satellite sites

Number of buildings :~ 674
10m² up to 20.000m², 425,000 m² of surface
60% of the buildings are 30+ years old

Tunnel lengths : > 70 km
Caverns: > 80
30 km of roads
1000 km of buried services

Total CERN fenced territory : 208 hect.
Total CERN unfenced territory : 418 hect

- **fenced territory - CH: 51 hect.**
- **unfenced territory - CH : 59 hect.**
- **fenced territory - F : 157 hect.**
- **unfenced territory - F: 359 hect.**

494 hostel rooms in Meyrin Site

~ 2300 Staff
~ 700 Fellows and Paid Assoc.
~ 10'000 Users
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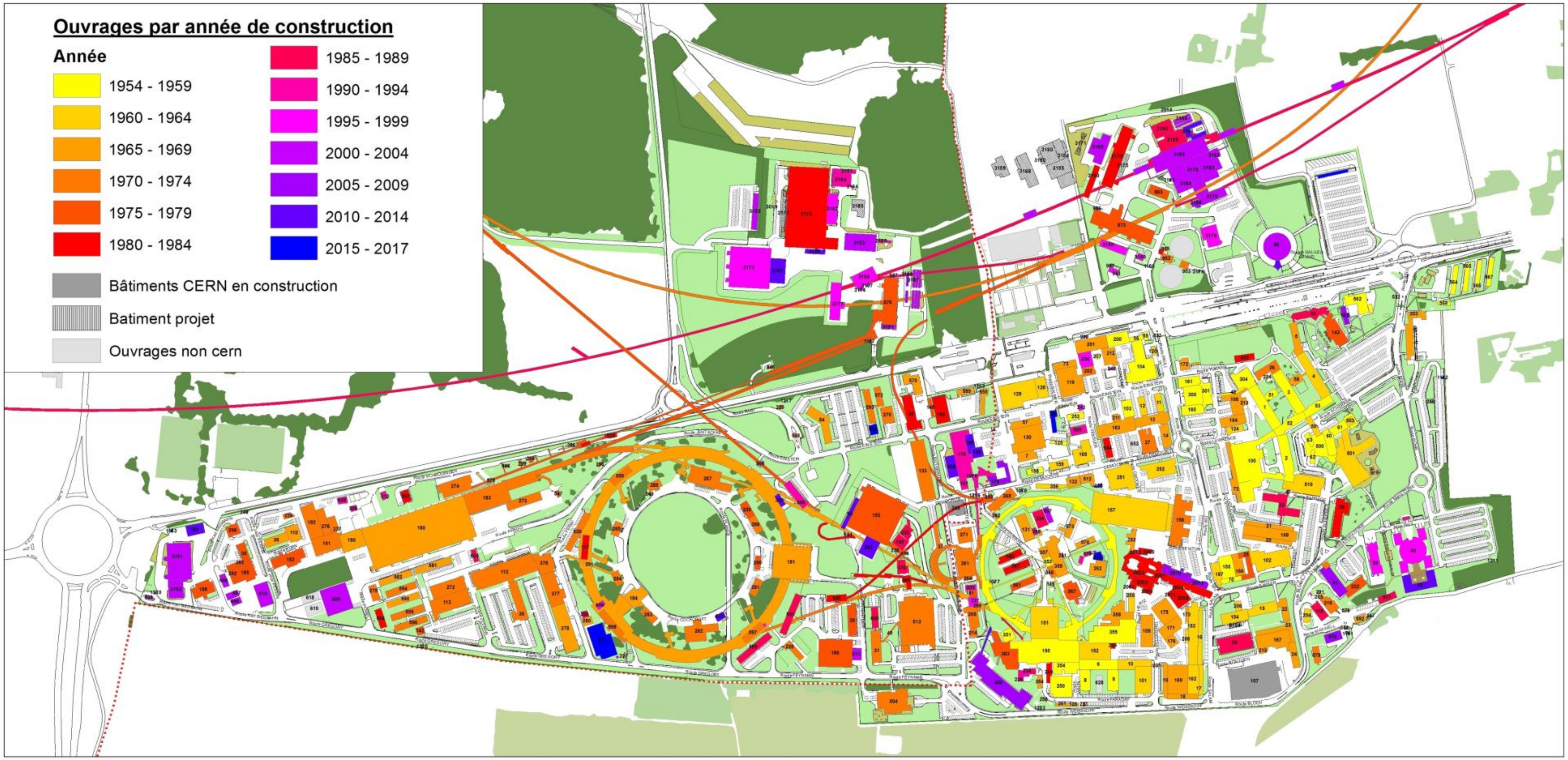
9'500 people every day at CERN

CERN Tertiary buildings

- 260 are dedicated to tertiary functions.
  - Most of these are more than 40 years old
- These functions are quite heterogeneous:
  - Offices
  - workshops and warehouse
  - 2 large heating plants (~50 MW overall capacity
  - 27 km district heating network
  - 200 heating local circuit
  - 3 restaurants
  - 3 hotels
  - 1 kindergarten.

Meyrin site - Today



CERN Tertiary building functions

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SMART BUILDINGS

- Typical:
  - Connected sensors to monitor performance
  - Building energy management
  - Comfort of occupants….but they need to be engaged!

- Management:
  - Minimize Cost of Ownership.
    - Real time Asset Management.
    - Minimize maintenance costs (Ex smart lighting systems).
    - Reduce performance downtime.

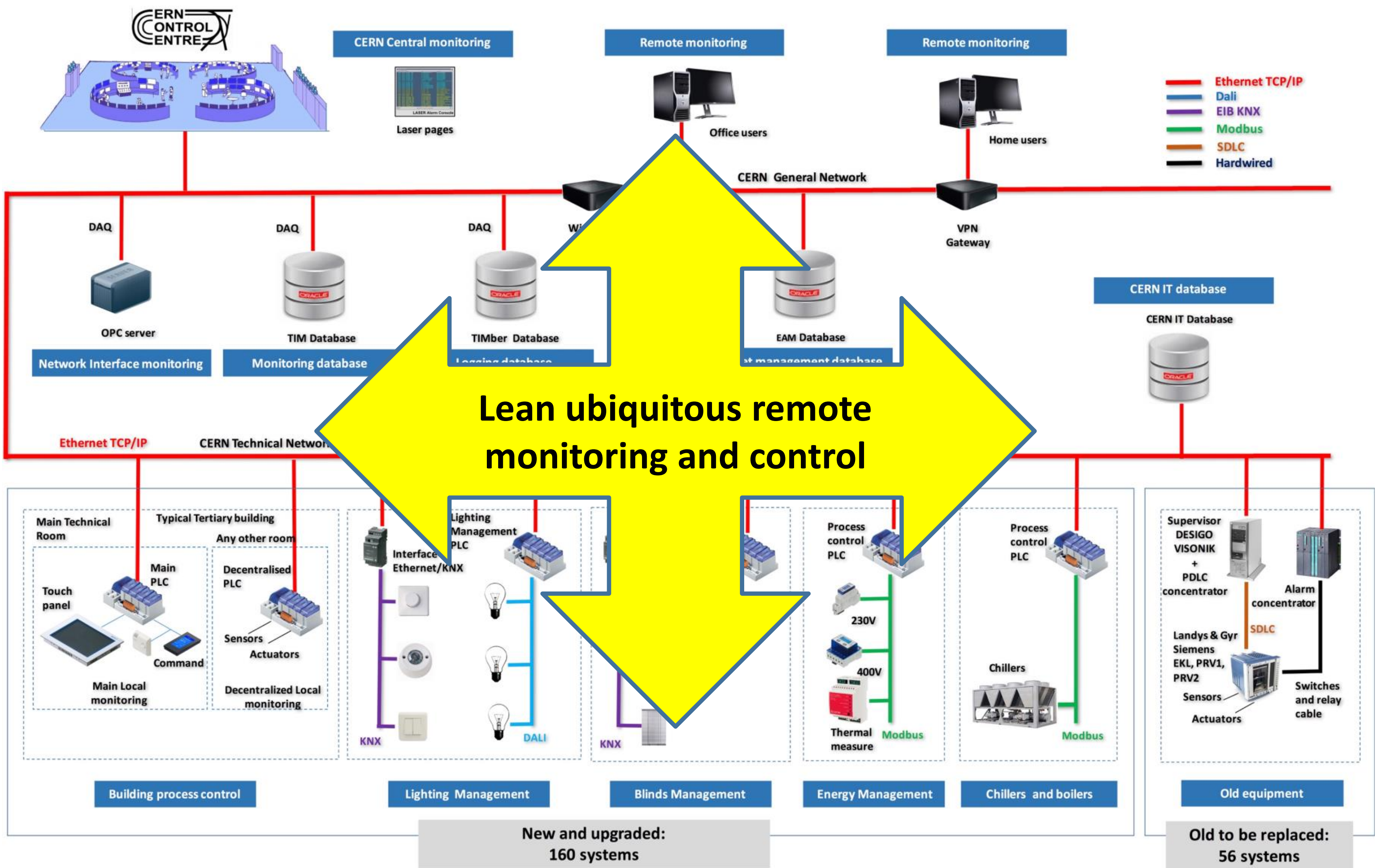
CERN SMART BUILDINGS ?

- Today, new are SMART by design….
- Can an old infrastructure become SMART?
- Yes -> incorporate smart building capabilities when renovating systems.
- Step-by-step process allows to develop the new smart capabilities along with the improvement of the building infrastructure.

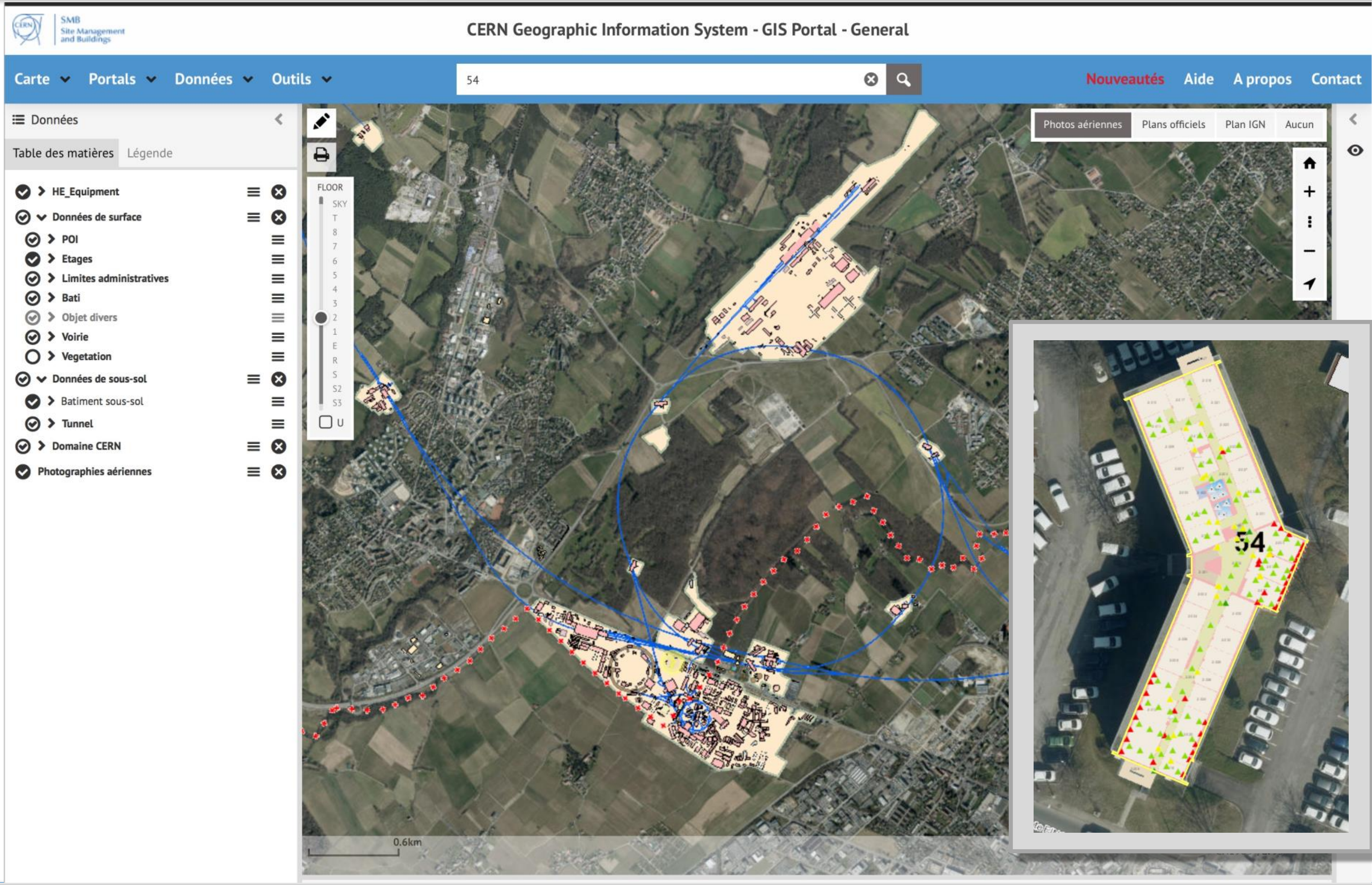
HOW?

- A novel methodology for the development and the integration of the new controlled building/infrastructure processes.
- The methodology allows to:
  - Interconnect seamlessly with different building systems using standard protocols
  - Reuse pieces of codes for reducing costs and improving maintainability
  - Remotely monitor the various distributed control systems without a centralised SCADA but rather using built in functions allowing access from a multitude of different platforms and locations.

Tertiary building infrastructure
Control & monitoring architecture



GIS and Asset management



IMPLEMENTATION EXAMPLE

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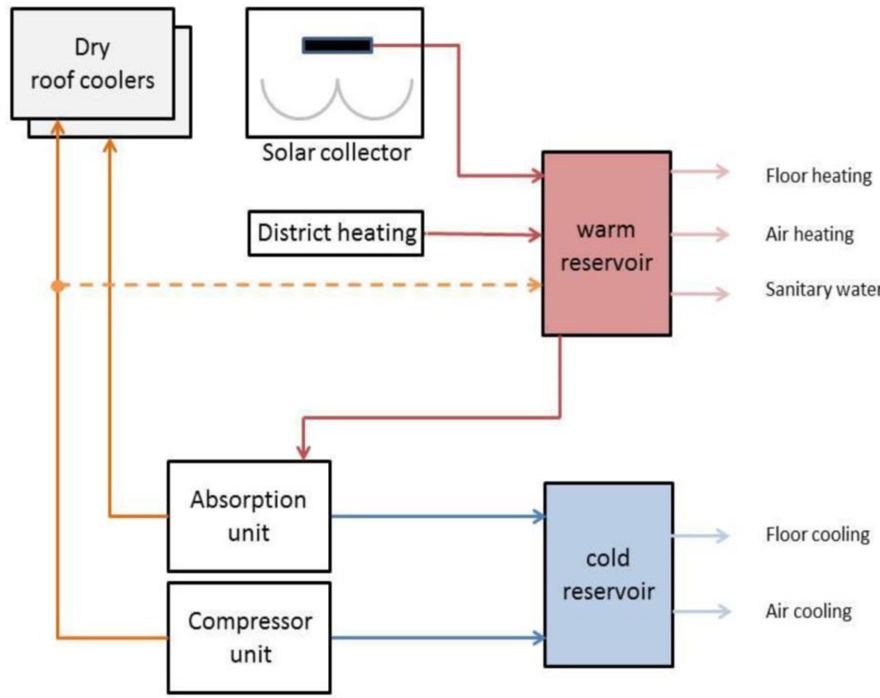
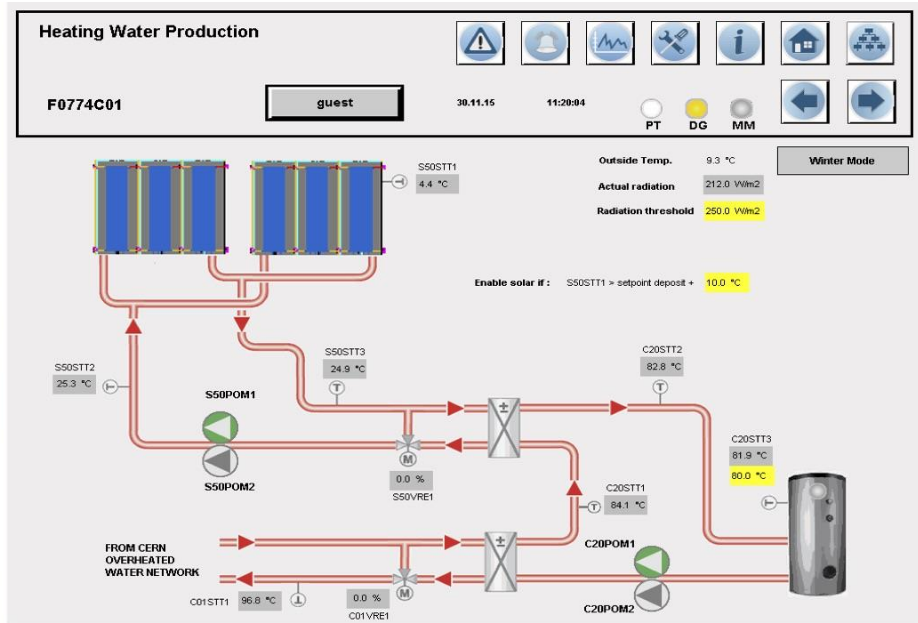
- green smart building
- integrated functions that allow the real-time monitoring and control of its energy management (heating, cooling, lighting and shading).
- implements an energy concept based on multiple productions (gas district heating, electricity and thermal solar collector) and energy recovery through air circulation

IMPLEMENTATION EXAMPLE

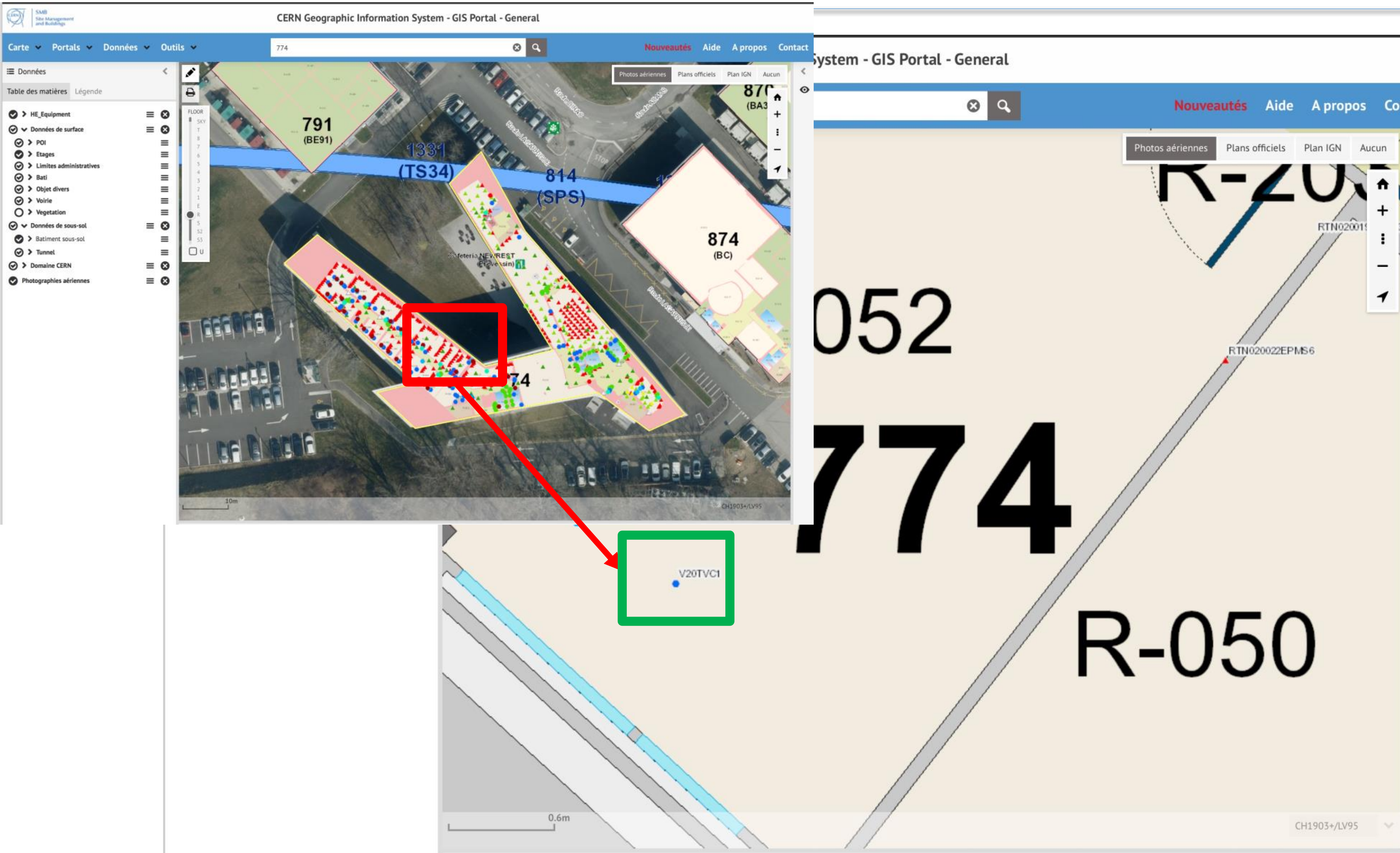
- Heat is used to:
  - produce hot water for space heating, for sanitary usage
  - Produce chilled water via an absorption system
  - a traditional compressor-driven cooling system is used when not sufficient solar energy.
- Energy usage is optimized:
  - Depending of the external weather conditions and the real-time heating/cooling needs of the building areas the energy flows are managed to maximize the usage of solar energy, hence reducing costs.



IMPLEMENTATION EXAMPLE



Asset management



CONCLUSIONS

- Building automation is going through a fundamental change with the introduction of smart connected devices.
- For large number of assets, systems owners either opt for proprietary solutions or to a tailored engineered solution.

- CERN has moved to an open, yet controlled, architecture that allows to manage a large number of building automation systems with limited resources.

- Future works:
  - Extend the park of smart buildings
  - Energy production optimization vs local demands
  - Extend integration of real time asset status to other life cycle functions.

Thank You for your attention

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