







ECLIPSE SENSINACT: OPEN PLATFORM FOR SMARTER CITIES,

APPLICATION IN SMART SKI RESORTS

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Eclipse IoT Days, Grenoble

OUTLINE

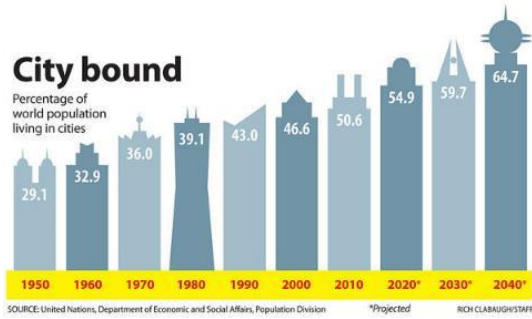
-  **Why Cities Need to be Smarter?**
-  **sensiNact, IoT Platform for Smarter Cities**
-  **Smart skiing with Eclipse sensiNact**
-  **Urban Technology Alliance**



WHY CITIES NEED TO BE SMARTER?

More than half of the world population lives in cities

On 2% of the earth's surface, cities use 75% of the world resources



WATER



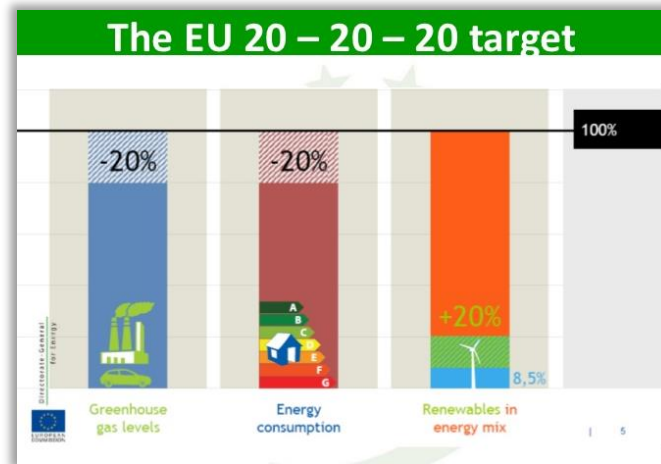
60%

Worldwide, up to of water is lost due to leaky pipes—to the tune of **US\$14 billion every year.**¹

IBM

Uexküll, Jakob. Shaping our future: Creating the World Future Council. Foxhole, Devon,

ENERGY



In Europe, **50%** of energy consumed today is imported – expected to reach **70%** by **2030**

TRANSPORT



In Europe and US, drivers spend **from 5 to 10 working days** per year **stuck in the traffic**

Senses of the city



Brain of the city



Data collection, analysis, knowledge, extraction, planning, action

Senses of the city



City data sources



Citizen-centric services

Brain of the city



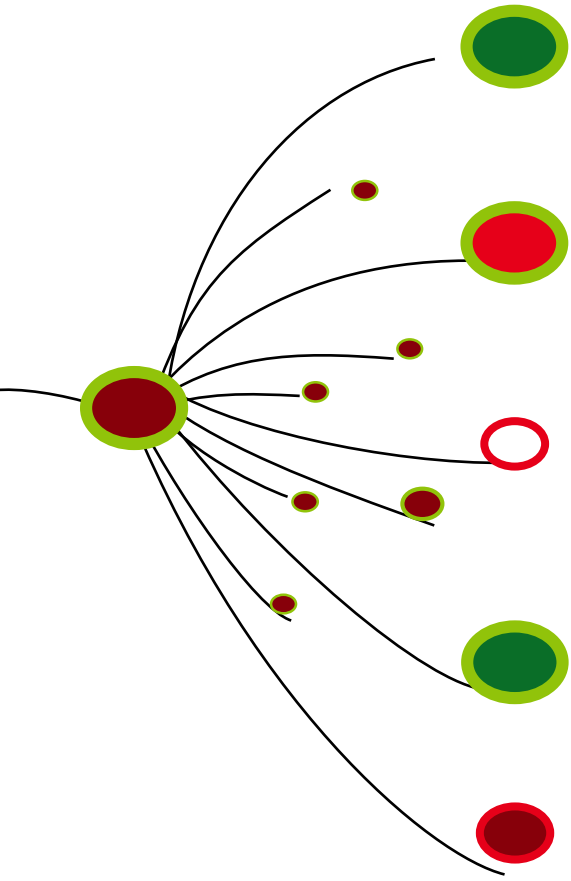
Data collection, analysis, knowledge, extraction, planning, action

Senses of the city



City data sources





Heterogeneity/Interoperability: How to handle the numerous types of devices, protocols, standards?

Scalability: How to handle the big number of connections/big data coming from millions of devices?

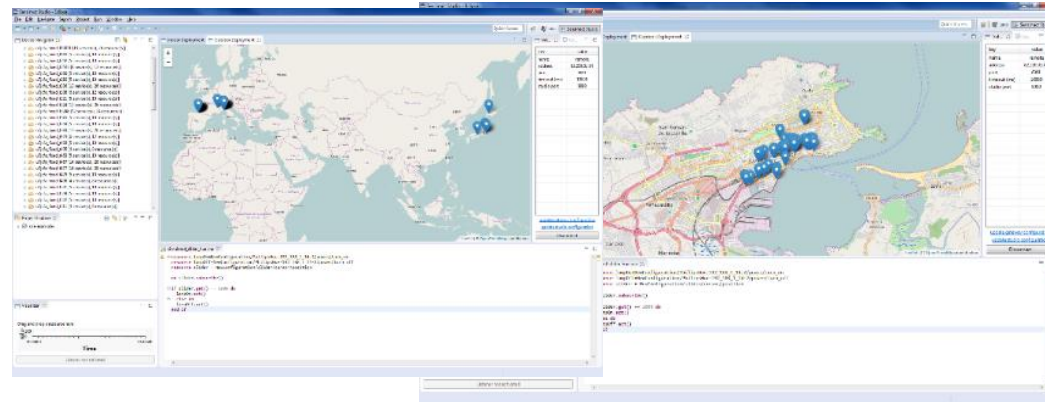
Dynamicity: plug&play, self-configuration, self-management, self-matchmaking

Dependability: rapid prototyping yet reliable dependable applications

Security and privacy by design

SENSINACT – IOT PLATFORM FOR SMARTER CITIES

sensiNact Studio



Tool for **rapid and dependable** application building

Various **northbound** protocols

Homogeneous Access
 - to **real-time data**: on-demand, periodically, event-based
 - **historic data**

Various **IoT** protocols and platforms

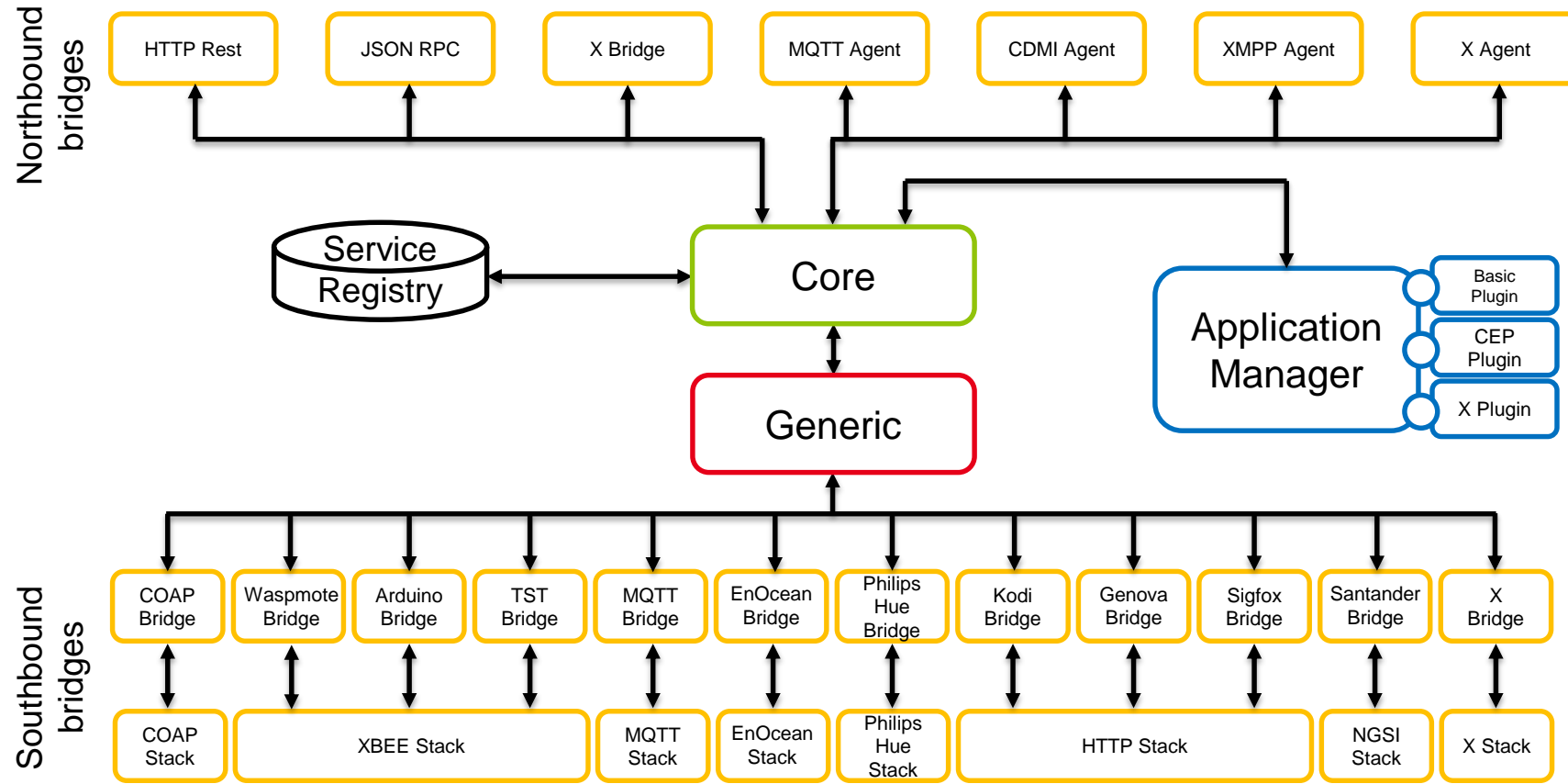
Heterogeneous IoT devices and platforms



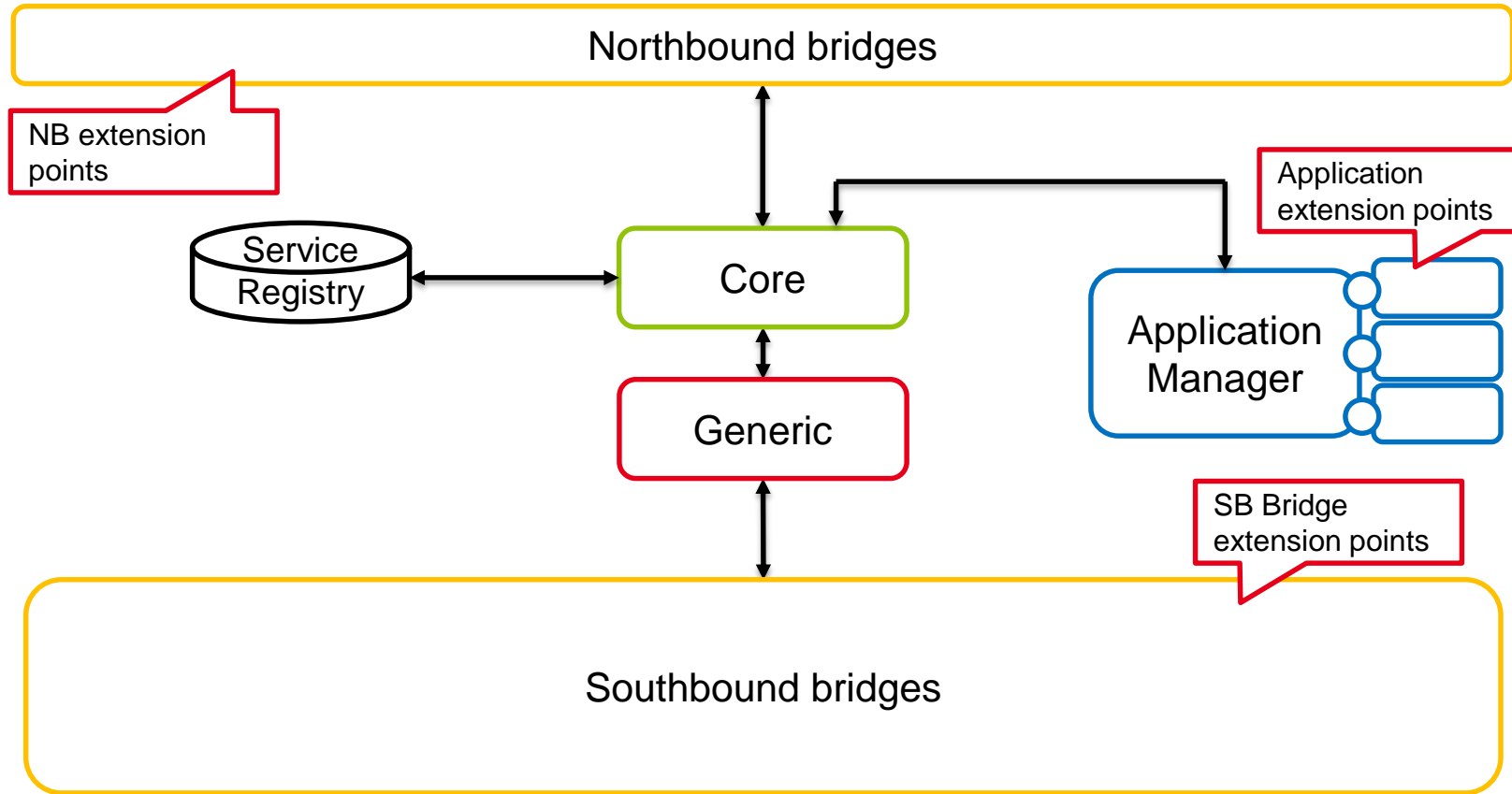
sensiNact Platform



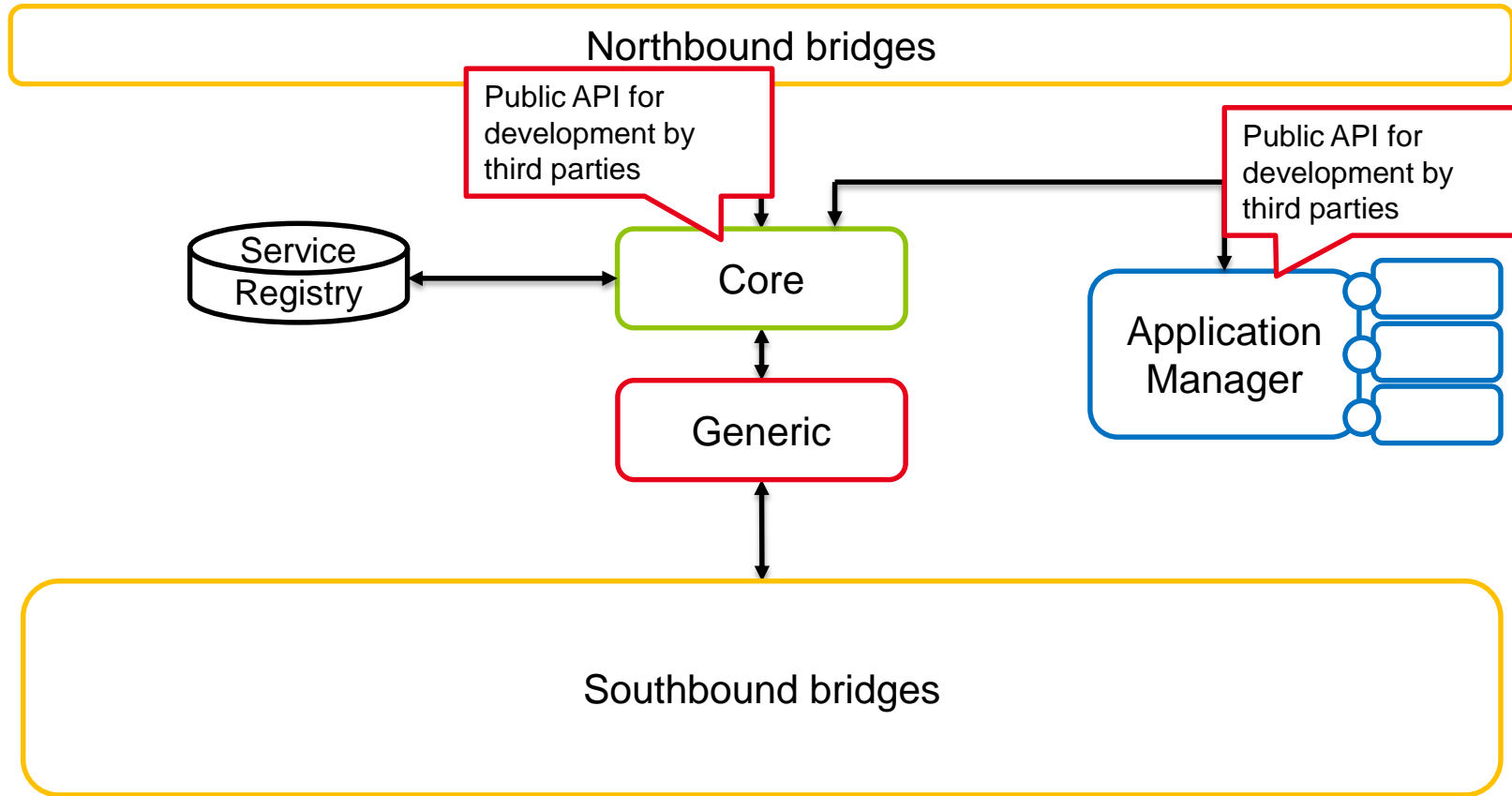
MODULAR ARCHITECTURE



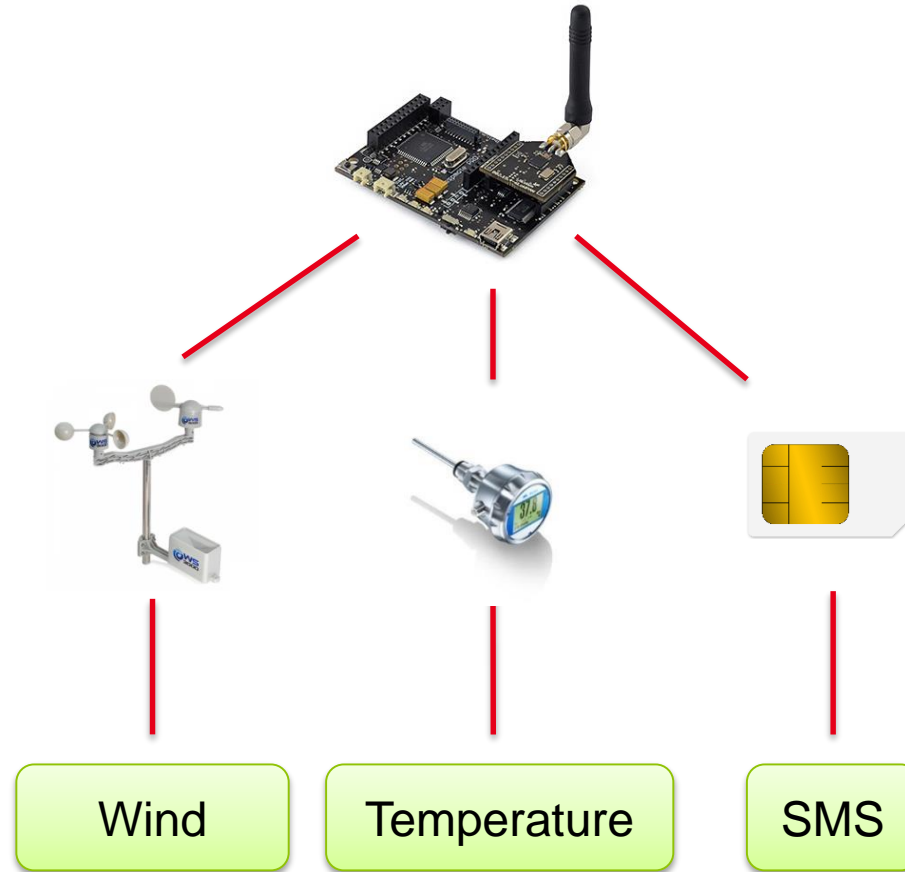
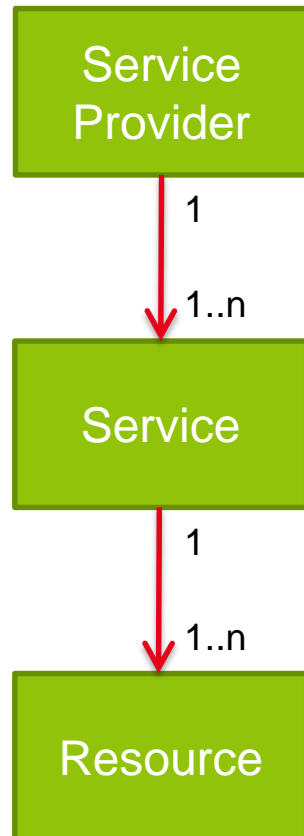
EXTENSION POINTS



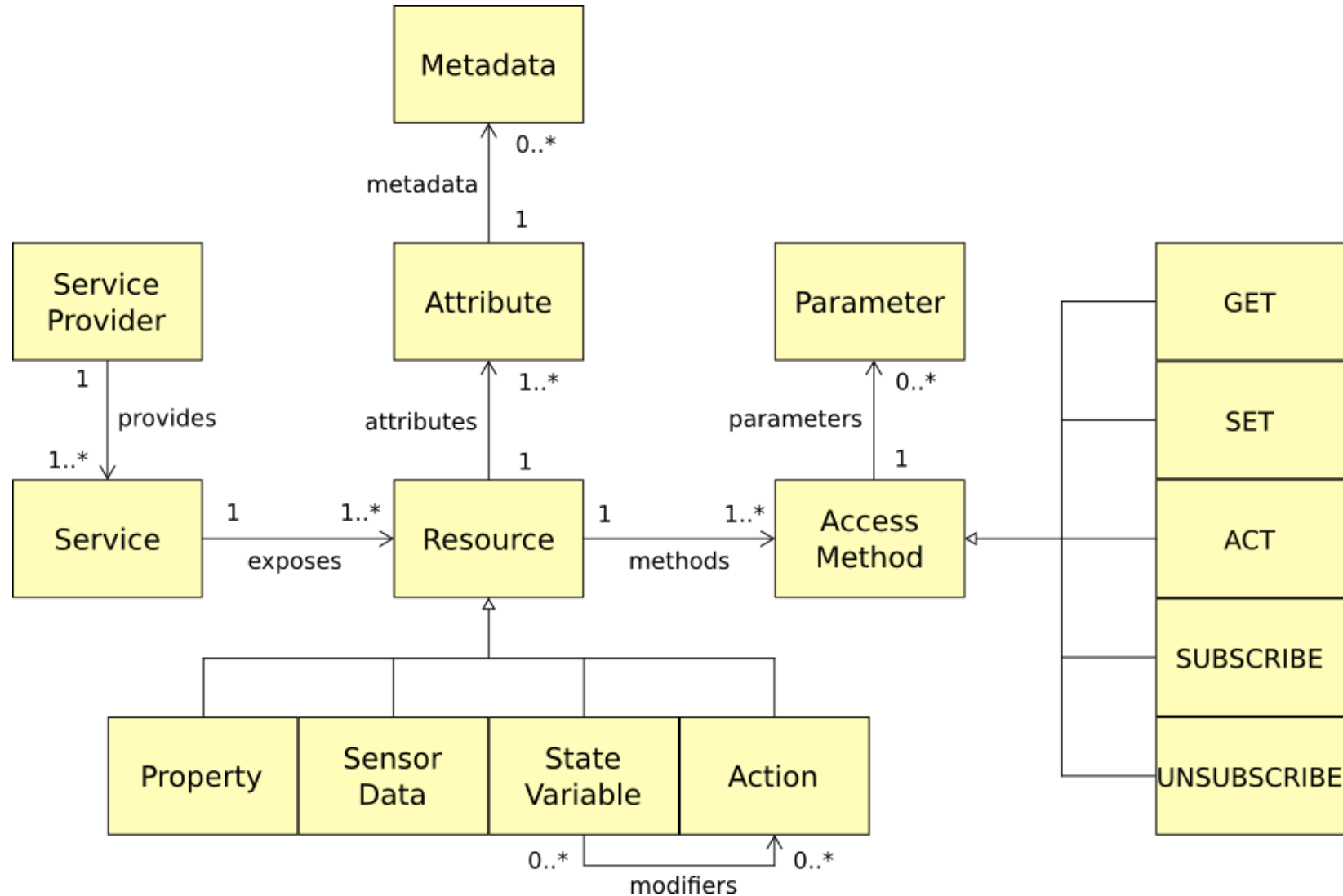
OPEN APIs FOR THIRD PARTY DEVELOPERS



EXAMPLE SENSINACT SERVICE PROVIDER



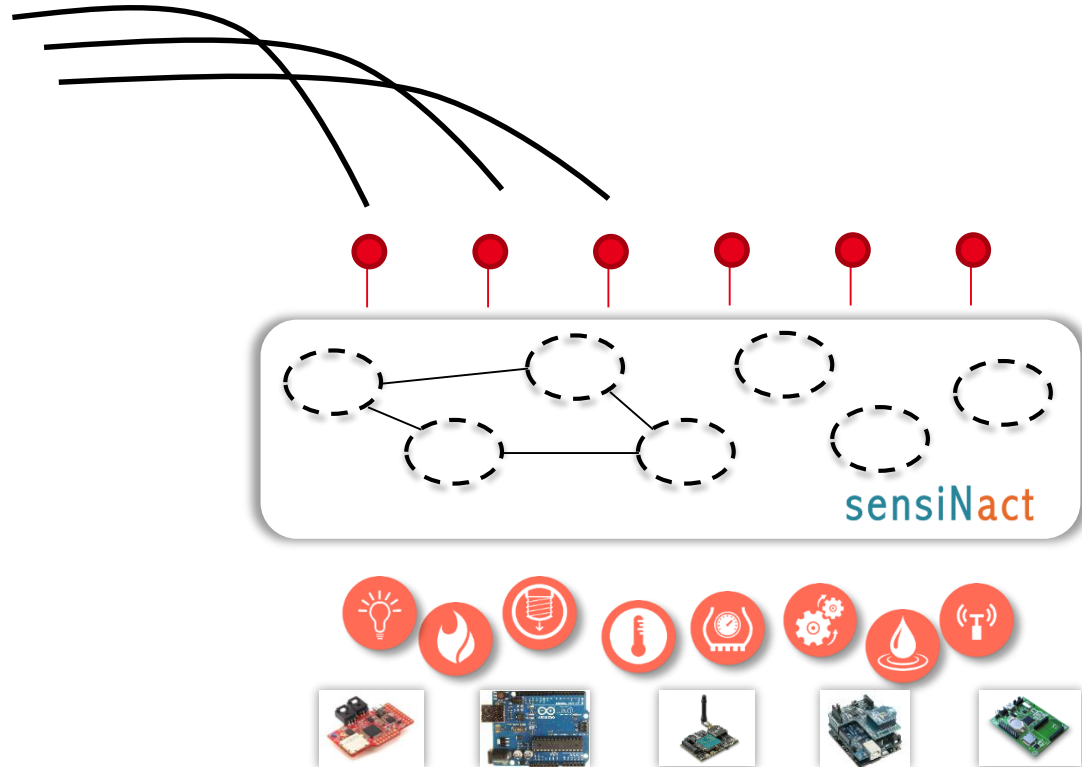
SENSINACT SERVICE MODEL





DEVELOPPERS

develop, deploy,
monitor, manage



APIs



SENSINACT STUDIO - DEVELOPMENT ENVIRONMENT



DEVELOPPERS

develop, deploy, monitor, manage

The screenshot displays the Sensinact Studio development environment. At the top, a window titled 'Sensinact Studio' shows a map of a city area with several blue location pins. Below the map, there is a code editor with a snippet of Java code: `if (location != null) { // ... } else { // ... }`. To the left of the code editor is a 'Project Explorer' showing a tree view of project resources. Below the code editor is a 'Visualizer' window displaying a line graph of 'power' over time, with values ranging from 0 to 25. The graph shows a step-like pattern with several peaks and troughs. The bottom part of the screenshot shows a detailed street map with various buildings and landmarks, including 'Av. de la Conception' and 'Av. de la Liberté'.



SENSINACT STUDIO: TOOL FOR IOT APPLICATION DEVELOPMENT AND DEPLOYMENT

The screenshot displays the Sensinact Studio interface with several key components highlighted by red boxes:

- Deployment View:** A map of London showing the River Thames and surrounding areas. Two data plots are overlaid on the map: "xbee://1336310592" showing PIR evolution and "coap://[aaaa:0000:0000:0000:c30c:0000:0000:000a]" showing SONAR evolution.
- Navigator View:** A tree view on the left side of the interface listing various components and services, such as "PHDGT_128045", "WSPT_XBEE_1336310592", and "ZLRT_COAP_0003".
- Properties View:** A table at the bottom left showing the properties of the selected component.
- DSL editor:** A code editor window in the center showing a snippet of code for subscribing to a service and triggering an LED service.
- Graphical Editor:** A state machine diagram on the right showing a process_0 with states like "average" and "temperature", and transitions triggered by events like "pir" and "hal".



SENSINACT STUDIO: TOOL FOR IOT APPLICATION DEVELOPMENT AND DEPLOYMENT

The screenshot displays the Sensinact Studio application interface. The main window is titled "<Sensinact Studio> - testAppManager/simple.sna - Sensinact Studio". The interface includes a menu bar (File, Edit, Navigate, Search, Project, Run, Window, Help) and a toolbar. On the left, there are two panels: "Device Navigator" and "Project Explorer". The "Device Navigator" panel is highlighted with a red border and contains a tree view of resources under a "clout" folder. The "Project Explorer" panel shows a similar tree view. The main area is a map titled "Outdoor Deployment" showing a geographical region with numerous blue location pins. A tooltip for a pin labeled "cloutweather_9" is visible, displaying weather data: location: 44.4378:8.8769, rainfall: 0, pressure: 1015.2, wind-speed: 8, temperature: 15.7, wind-orientation: 169, dew-point: 12, humidity: 82, wind-chill: 12.1. At the bottom left, there is a "Visualizer" panel with a graph titled "Drag and drop a resource here!". The graph has a y-axis labeled "value" ranging from 0 to 100 and an x-axis labeled "Time" ranging from 01:00:00 to 01:00:00. Below the graph, it says "Listener not activated".

Device Navigator:

- clout
 - airsensors_acquasola [2 service(s), 13 resource(s)]
 - admin [4 resources(s)]
 - airsensors [9 resources(s)]
 - location [Property]
 - NO2_Concentration [Property]
 - NO2_Concentration_1 [Property]
 - NO2_Concentration_2 [Property]
 - O3_Concentration [Property]
 - O3_Concentration_1 [Property]
 - O3_Concentration_2 [Property]
 - SO2_Concentration [Property]
 - SO2_Concentration_1 [Property]
 - airsensors_buenosaires [2 service(s), 11 resource(s)]
 - airsensors_busalla [2 service(s), 14 resource(s)]
 - airsensors_campora [2 service(s), 14 resource(s)]
 - airsensors_chiavari [2 service(s), 11 resource(s)]
 - airsensors_cogoleto2 [2 service(s), 13 resource(s)]
 - airsensors_europa [2 service(s), 12 resource(s)]
 - airsensors_firenze [2 service(s), 15 resource(s)]
 - airsensors_giovi [2 service(s), 8 resource(s)]

Visualizer:

Drag and drop a resource here !

value

Time

Listener not activated



SENSINACT STUDIO: TOOL FOR IOT APPLICATION DEVELOPMENT AND DEPLOYMENT

The screenshot displays the Sensinact Studio interface with the following components:

- Device Navigator:** A tree view on the left showing a project named 'sido' with a hierarchy of folders and resources. The 'contact [SensorData]' resource is selected.
- Outdoor Deployment:** A central map view showing a floor plan with several blue location pins. A tooltip for 'sido/0x002588a9' is visible, listing '+ admin', '+ a', and '+ b'.
- Visualizer:** A graph at the bottom left showing the value of 'sido/0x002588a9/a/contact' over time. The y-axis is labeled 'value' (0 to 100) and the x-axis is 'Time' (01:00:00 to 01:00:00). A 'Stop listener' button is at the bottom.
- Code Editor:** A text editor at the bottom right showing code for 'simple.sna'. The code is enclosed in a red box and includes resource definitions and an event listener.

```
simple.sna | sonnette.sna | notif.sna
@resource button=[sido/0x002588a9/a/contact]
@resource ON=[sido/PhilipsHue-192_168_1_14-2/power/turn_on]
@resource OFF=[sido/PhilipsHue-192_168_1_14-2/power/turn_off]

on button.subscribe()
@if button.get() == true do
  ON.act()
@else do
  OFF.act()
end if
```


DEDICATED DOMAIN SPECIFIC LANGUAGE

- A DSL for building IoT applications based on Event Condition Action rules
- ON Event IF Condition DO Action

ON presence=PIRService.pir.**subscribe()**

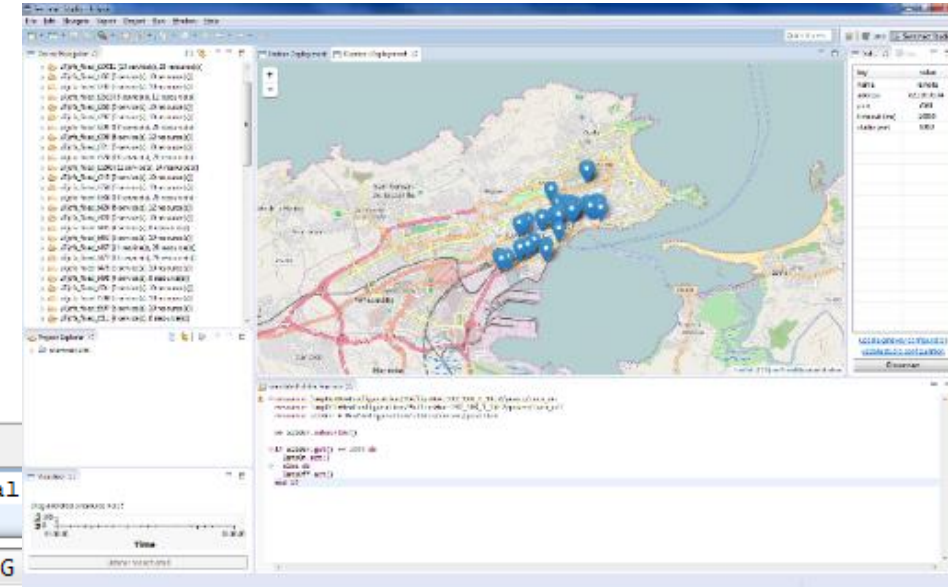
IF presence==true

DO LightService.lightOn.**act()**;

ELSE

DO LightService.lightOff.**act()**;

```
*test.sna
ON pir=pir.subscribe(),hal= hal
IF pir==true and hall==open
DO turn_on.act()
```



ON presence=**during**(PIRService1.pir.**subscribe()**==true,
PIRService2.pir.**subscribe()**==true,
3)

IF presence==true

DO LightService.lightOn.**act()**;

ELSE

DO LightService.lightOff.**act()**;





sensiNact smart city platform has just joined  **eclipse**

<https://projects.eclipse.org/projects/technology.sensinact>



ACCESS TO VARIOUS CITY REAL-LIFE DATA IN REAL-TIME

sensinact

Navigator + -

- house-ac_air_s
- house-ac_mode_g
- house-ac_mode_s
- house-ac_roomhmd
- house-ac_roomtmp
- house-ac_switch_g
- house-ac_tmp_g
- house-ac_tmp_s
- house-air_dirh
- house-air_dirv
- house-air_speed
- house-batter...

Visualizer

Choose a resource.

smartsantander_u7jefa_t508
lat: 43.46424
lng: -3.80545
illuminance/sensor: 48.4
batteryLevel/sensor: 67
temperature: ambient/sensor: 16.64

sensinact

Navigator + -

- house-ac_air_s
- house-ac_mode_g
- house-ac_mode_s
- house-ac_roomhmd
- house-ac_roomtmp
- house-ac_switch_g
- house-ac_tmp_g
- house-ac_tmp_s
- house-air_dirh
- house-air_dirv
- house-air_speed
- house-batter...

Visualizer

Choose a resource.

carsensor019
lat: 35.3779
lng: 139.446525
Angular Velocity X/sensor: -2.0752269779507135
Angular Velocity Y/sensor: -0.18310826276035705
UV/sensor: 8.1915
Angular Velocity Z/sensor: 0.061036087586785685
Speed/sensor: 0.04
Satellite Number/sensor: 10
Acceleration Y/sensor: -1.096561092545968
Course/sensor: 231.98
Acceleration X/sensor: 0.3543472526131075
Atmospheric Pressure/sensor: 1012.4060425726711
Serial Number/sensor: 019
Acceleration Z/sensor: 10.276070325780116
Data Index/sensor: 360191
Atmospheric Humidity/sensor: 75.09375
PM2.5/sensor: 0.0



LOOKING FOR CONTRIBUTIONS!

Eclipse sensiNact

Overview Downloads Who's Involved Developer Resources Governance

The Eclipse sensiNact project consists of a software platform enabling the collection of data relevant to improving the quality of life of urban citizens, programming interfaces to data (on-demand, periodic, historic, etc.) and application development and deployment of innovative applications on top of the platform.

Here a quick look to the existing data available via sensiNact platform from various Fujisawa and Osaka (click the "+" button and click "Add" accepting the default gateway).

At the heart of sensiNact lies its service-oriented approach in which IoT devices expose functionalities in terms of services (temperature service, presence detection service, quality monitoring service, alarm service, etc.). Each service then exposes one or several resources such as sensor data or actions. Building applications thus becomes a matter of composing sensing services with actuation services. Loosely coupling between the clients and the services they implement makes the composition of services more dynamic and adaptable to the changing context, not only in the software environment (increasing memory usage, low battery, reducing quality of measures, etc.) but also in the physical environment (replacing sensors, changing localization, etc.).

sensiNact particularly deals with the following 4 topics.

Connectivity

Heterogeneity of data is today's reality in every urban environment. Emerging IoT devices, a number of social networks, mobile applications, open data repositories and web data sources. sensiNact thus provides connectivity support to those data sources including such as LoRa, Zigbee, IEEE 802.15.4, Sigfox, enOcean, MQTT, XMPP, NGSI, HTTP, CoAP. Connectivity support for new protocols can be rapidly developed and dynamically adapted.

Interoperability

The data model

sensiNact

http://localhost 8080 Validate

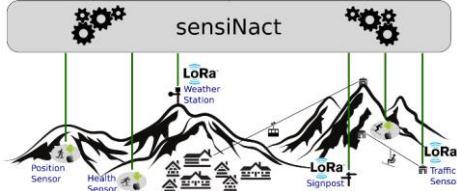
sensiNact REST API

default

Show/Hide | List Operations | Expand Operations

GET	/providers
GET	/providers/{providerId}
GET	/providers/{providerId}/services
GET	/providers/{providerId}/services/{serviceId}
GET	/providers/{providerId}/services/{serviceId}/resources
GET	/providers/{providerId}/services/{serviceId}/resources/{resourceId}
GET	/providers/{providerId}/services/{serviceId}/resources/{resourceId}/GET
POST	/providers/{providerId}/services/{serviceId}/resources/{resourceId}/SET
POST	/providers/{providerId}/services/{serviceId}/resources/{resourceId}/ACT
POST	/providers/{providerId}/services/{serviceId}/resources/{resourceId}/SUBSCRIBE
POST	/providers/{providerId}/services/{serviceId}/resources/{resourceId}/UNSUBSCRIBE

Services, the system resource : GET resource to an ally introduces non all the tamic build.



Chamrousse, PyeongChang **smart ski station**



PTL



iHouse



smart train station

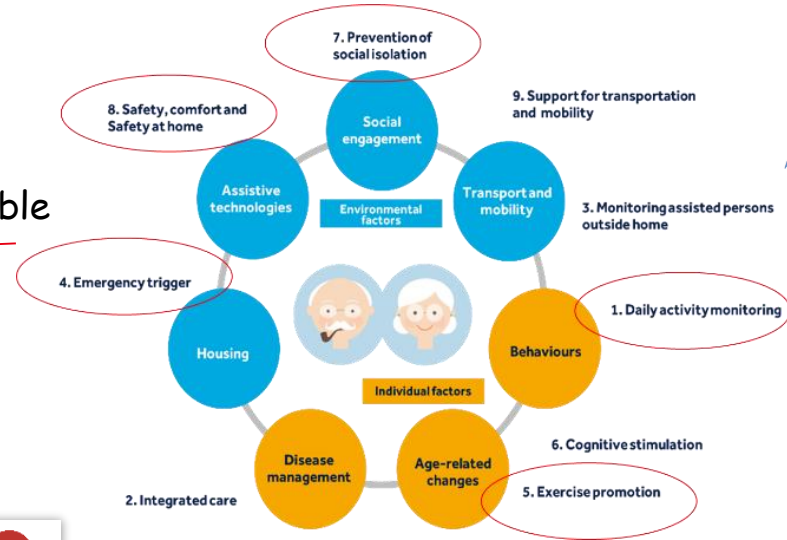
Kameoka, Maya, Osaka



Smart home

Grenoble

Smart living & well-ageing



ACTivating InnoVative IoT smart living environments for AGEing well



Smart farming



Bordeaux, Dubourdiou Wineyard

Smart city



Genova, Santander, Fujisawa, Mitaka, Grenoble, Bristol, London, Aarhus





WISE IQT

SMART SKIING

The case of Chamrousse

Rémi Druilhe (CEA)



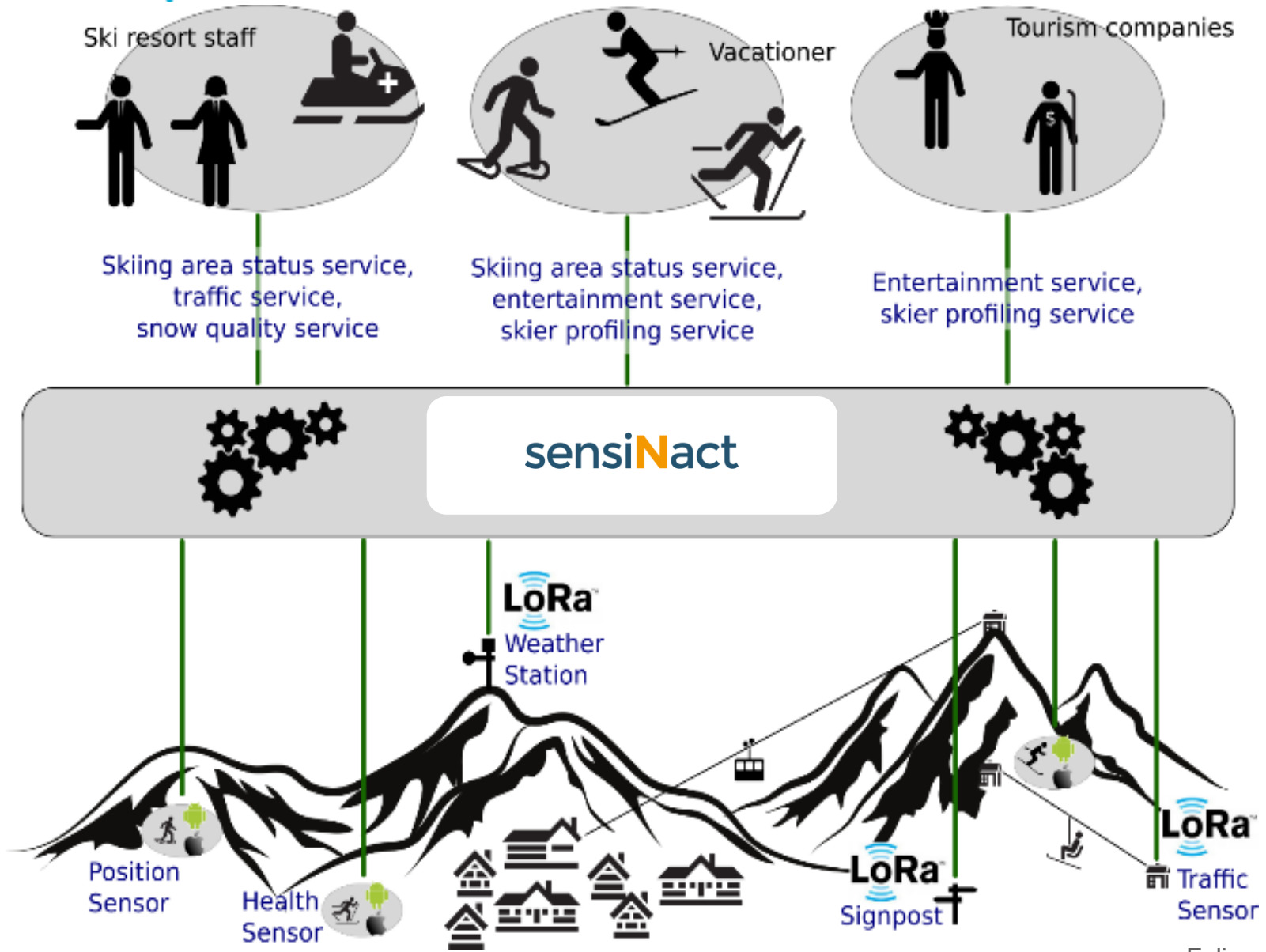
NEC PIQ Sport Intelligence



n|w University of Applied Sciences and Arts Northwestern Switzerland



IOT FOR SMART SKI RESORTS



IMPLEMENTED CASES

- **The project proposes various use cases for the skiers and for the ski resort**
 - Skier side (experience in Chamrousse, Europe)
 - Assets tracking of the skiers
 - Traffic monitoring
 - « Conquer the slope »
 - Ski resort side (experience in Alpensia, Korea)
 - Location of the rescues/instructor
 - Rescue button
 - Display of the traffic in the ski resort (ongoing)

- **Each use case are reproducible on the other country**

ASSETS TRACKING

- A European skier wants to ski in Korea for the Winter Olympic Games in 2018.
- During his trip, he wants to know the location of his skis.
- A low power location sensor is attached to the skis.
- Those information are displayed in a mobile application.
- The roaming service between Europe and Korea allows to retrieve this information no matter the Internet provider and it is transparent to the user.
- Moreover, the user can access to those data without being close to his skis.

CONQUER THE SLOPE

- Using a sport sensor, the skier can participate to competitions with other skiers in order to determine, according to various criteria, who is the best on this slope.
- The sport sensor detects the start of the skier, saves its performance and displays it on a leaderboard.
- If the skier is beaten by another skier, he is notified and can try again
- At the end of the day/week/season, a leader is designated and gains discount voucher for local shops



DISPLAY OF THE TRAFFIC IN THE SKI RESORT (ONGOING)

- Analyze of the traffic near the ski lifts using network activity processing (WiFi and Bluetooth)
- The result is displayed on a map using simple icons
- The skier looks at this map and adapt its journey in consequence
- The information is also retrieve by the manager of the ski resort as a guide.

DEPLOYMENT IN CHAMROUSSE SKI RESORT

- Deployment of Lora gateway and connected bracelets
 - For asset monitoring
 - For skier performance monitoring
 - Connected LORA (Solu-M) and BLE enabled sensors (PIQ Robot) carried by skiers



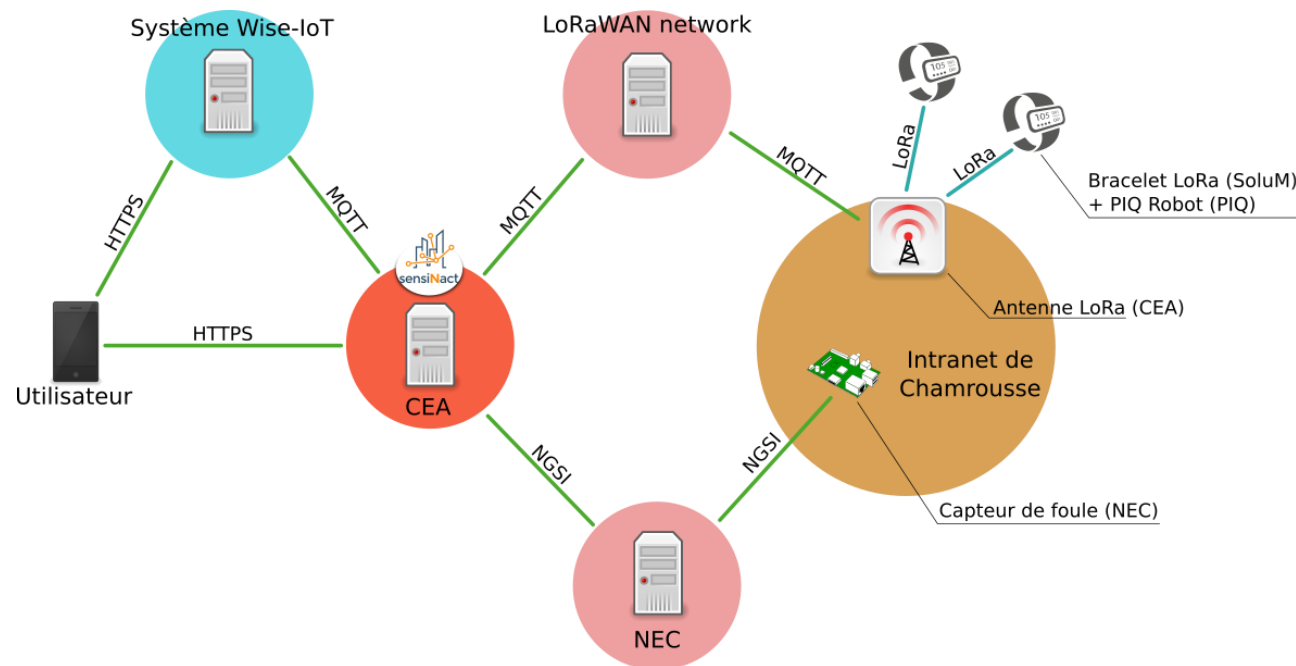
sensiNact

- Crowd detectors from NEC Europe (ongoing)
 - Collect the network activity (WiFi and Bluetooth) to determine the quantity of skiers in an area
 - Deployment in Recoin and Roche Béranger



DEPLOYMENT ARCHITECTURE

- **Deployment of the gateways/devices in Chamrousse**
- **Deployment of Eclipse sensiNact, the open source IoT platform**
 - Using a LoRaWAN network community (e.g, TheThingsNetwork, Hokawan)
 - Using the traffic data from NEC
- **Transfer to the Wise-IoT recommendation system for further processing if necessary**
- **Display of the data on the smartphone of the user**



COLLECTED DATA

LoRa band

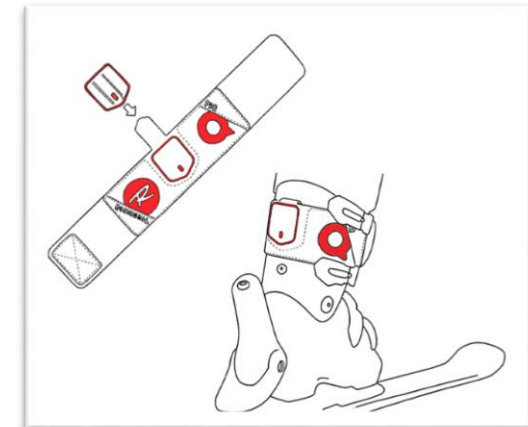
- GPS location

PIQ Robot

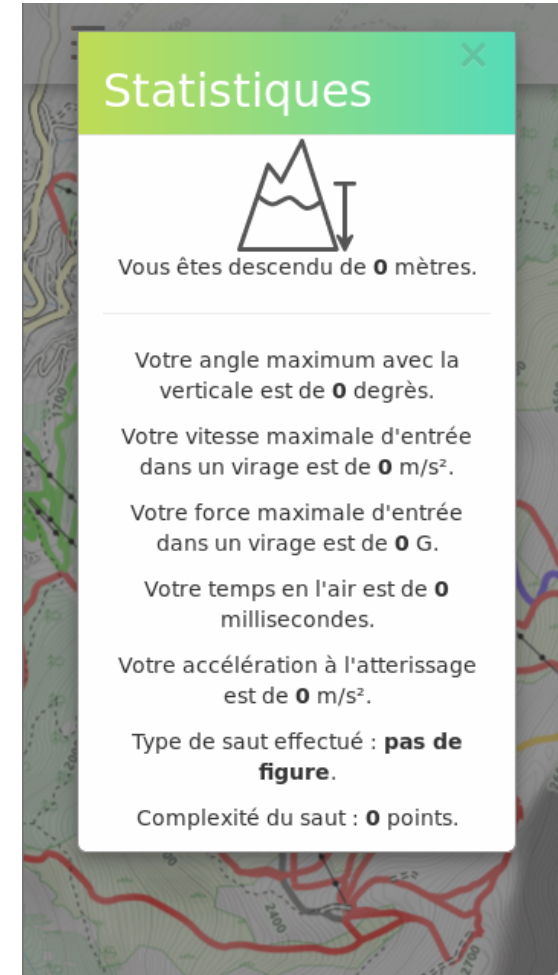
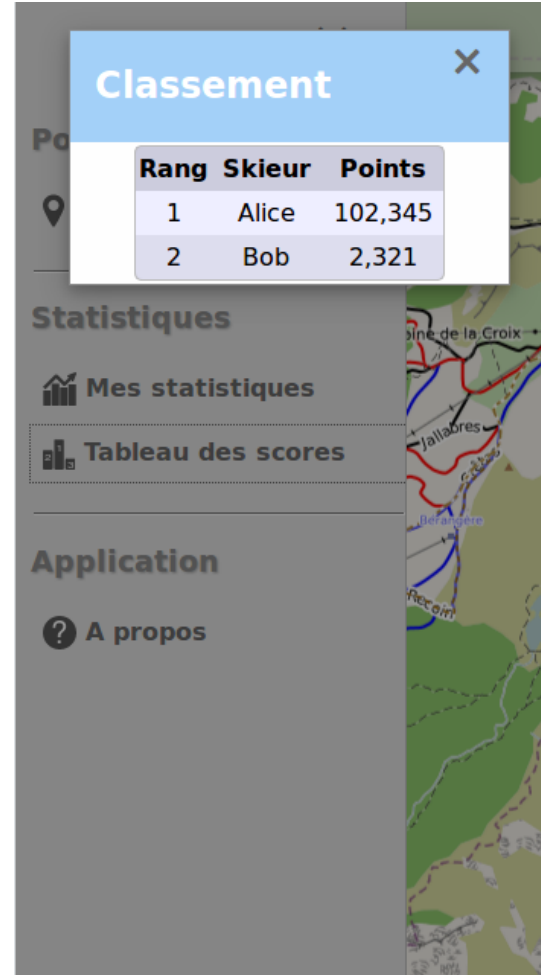
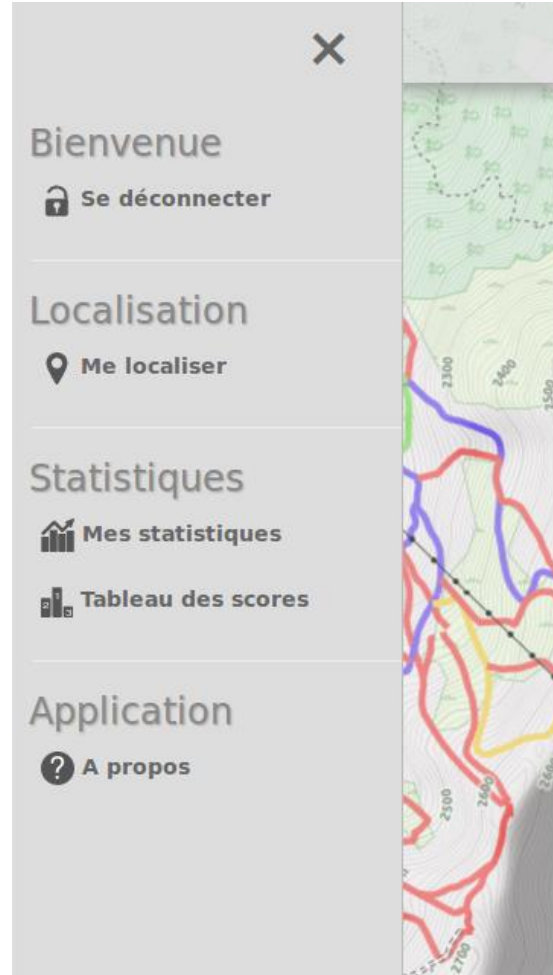
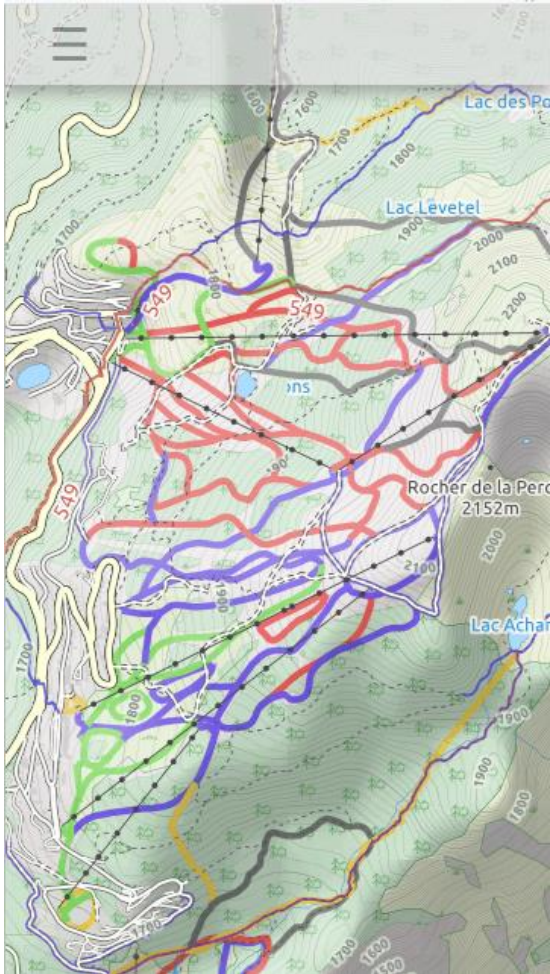
- Number of turns with maximum angle ski
- Maximum angle of the skier from the vertical
- Number of turns with maximum velocity
- Maximum speed of entry into the turn of the skier
- Number of jump with maximum air time
- Maximum air time
- Number of jump with best score rotation
- Complexity of the jump
- Descent height

Crowd detector

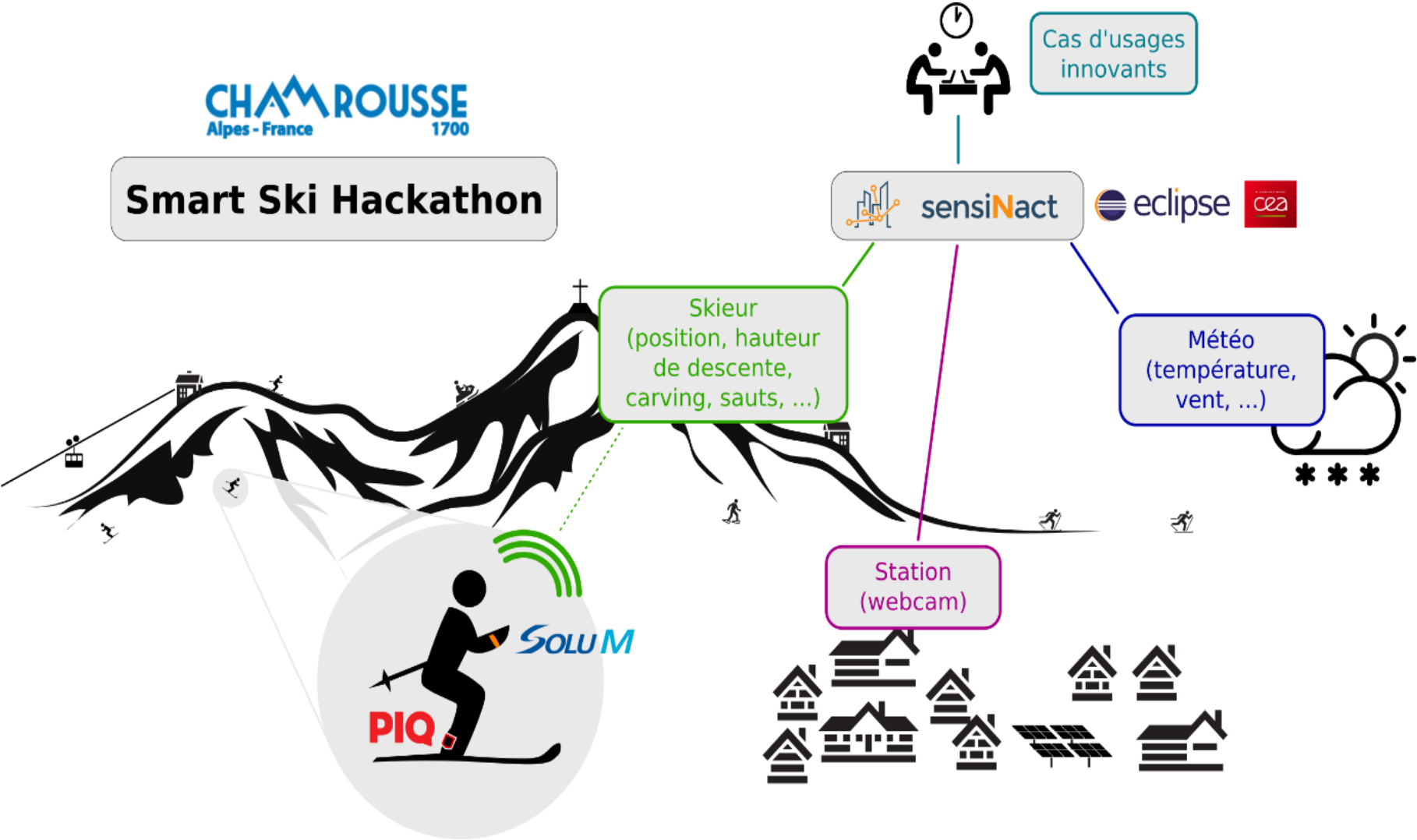
- Number of persons in a given area



THE APPLICATION

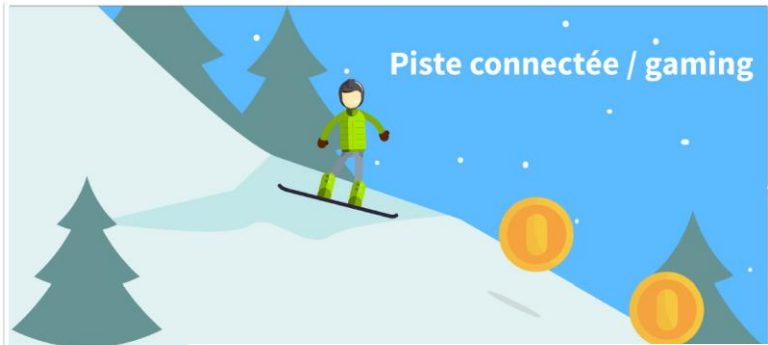


CHAMROUSSE HACKATHON – JANUARY 21ST

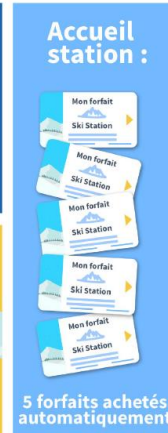




VARIOUS OTHER USE CASES



dès leur départ de domicile, ser leur voyage :



PC parking relais : 1 place de voiture est automatiquement réservée

Les 2 (points)



Tout le monde prend son smartphone pour découvrir le lieu et le chemin pour s'y rendre (= un restaurant).

+10% de clients par rapport au week-end précédent
6/10 ont expérimenté les nouvelles activités et en sont satisfaits
3/10 départs de secouristes ont été lancés par les bracelets connectés
Affluence aux remontées et dysfonctionnements du jour

SENSINACT IOT PLATFORM FOR SMART CITIES

- **Plug&play:** Device as a Service Approach. Flexibility of adding/removing/updating devices with a minimum impact on the running platform.
- **Modular:** Modular development and deployment for enhanced system maintenance and evolution
- **Dependable:** Formal data and service model to facilitate reliable IoT applications development.
- **Scalable:** Three layers architecture (device/gateway/cloud) allowing distribution of data processing at different levels.
- **Easy&quick:** Comprehensive data model and APIs helping to rapidly build IoT applications.



Urban Technology Alliance



Testbed-oriented global alliance on promoting open smart city platforms and tools

- ▶ **One-stop showcase** for a comprehensible set of integrated open smart city solutions
- ▶ **Organize pilot deployments and testbeds** with the member cities for validation and promotion of partners' software/hardware/network solutions.
- ▶ Provide **direct contact between city authorities and solution developers** and identify real requirements for smarter urban environments
- ▶ Use a **common language** comprehensible by each stakeholder: cities, citizens, politicians, technicians, researchers, ...
- ▶ **Create a business ecosystem** among the members to build end-to-end solutions
- ▶ Organize events to **exchange best practices, lessons learnt, know-how** with other national and international initiatives.





Thank you for your
attention!



Join Us!

Contact

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