ECLIPSE SENSINACT: OPEN PLATFORM FOR SMARTER CITIES,
APPLICATION IN SMART SKI RESORTS

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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

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

WATER

Worldwide, up to 60% of water is lost due to leaky pipes—to the tune of USD 14 billion every year. IBM
City data sources

- Social networks
- Mobile applications
- WorldWideWeb
- Legacy Devices
- IoT Devices

Senses of the city
Brain of the city

Senses of the city

Smart City Platform

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

City data sources

- Social networks
- Mobile applications
- WorldWideWeb
- Legacy Devices
- IoT Devices

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Citizen-centric services

Brain of the city

Smart City Platform

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

Senses of the city

City data sources

Social networks
Mobile applications
WorldWideWeb
Legacy Devices
IoT Devices

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STILL MANY TECHNICAL CHALLENGES

- **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

**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

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MODULAR ARCHITECTURE

Northbound bridges:
- HTTP Rest
- JSON RPC
- X Bridge
- MQTT Agent
- CDMI Agent
- XMPP Agent
- X Agent

Service Registry

Core

Generic

Application Manager

Basic Plugin
CEP Plugin
X Plugin

Southbound bridges:
- COAP Bridge
- Waspmote Bridge
- Arduino Bridge
- TST Bridge
- MQTT Bridge
- EnOcean Bridge
- Philips Hue Bridge
- Kodi Bridge
- Genova Bridge
- Sigfox Bridge
- Santander Bridge
- X Bridge

- COAP Stack
- XBEE Stack
- MQTT Stack
- EnOcean Stack
- Philips Hue Stack
- HTTP Stack
- NGSI Stack
- X Stack

...
EXTENSION POINTS

Northbound bridges

NB extension points

Service Registry

Core

Generic

Application extension points

Application Manager

SB Bridge extension points

Southbound bridges
OPEN APIs FOR THIRD PARTY DEVELOPERS

Northbound bridges
- Public API for development by third parties
  - Core
  - Generic
  - Application Manager

Southbound bridges
- Service Registry
  - Public API for development by third parties

...
EXAMPLE SENSINACT SERVICE PROVIDER

Service Provider

1

1..n

Service

1

1..n

Resource

Wind
Temperature
SMS
SENSINACT SERVICE MODEL

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SENSING AND ACTUATION SERVICES

DEVELOPERS

develop, deploy, monitor, manage

APIs

sensiNact

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SENSINACT STUDIO - DEVELOPMENT ENVIRONMENT

DEVELOPERS

develop, deploy, monitor, manage
SENSINACT STUDIO: TOOL FOR IOT APPLICATION DEVELOPMENT AND DEPLOYMENT

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SENSINACT STUDIO: TOOL FOR IOT APPLICATION DEVELOPMENT AND DEPLOYMENT

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SENSINACT STUDIO: TOOL FOR IOT APPLICATION DEVELOPMENT AND DEPLOYMENT
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();

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

https://projects.eclipse.org/projects/technology.sensinact
ACCESS TO VARIOUS CITY REAL-LIFE DATA IN REAL-TIME
LOOKING FOR CONTRIBUTIONS!

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Eclipse sensiNact

The Eclipse sensiNact project consists of a software platform enabling the collection data relevant to improving the quality of life of urban citizens, programming interfa to data (on-demand, periodic, historic, etc.) and application development and dep 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 gate At the heart of sensiNact lies its service-oriented approach in which IoT devices exp functionalities in terms of services (temperature service, presence detection service quality monitoring service, alarm service, etc.). Each service then exposes one or se resources such as sensor data or actions. Building applications thus become a mapp composing sensiNact services with actuation services. Loosely coupling between the i and the services they implement makes the composition of services more dynamic 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 phys environment (replacing sensors, changing localization, etc.).

sensiNact REST API

**default**

<table>
<thead>
<tr>
<th>Method</th>
<th>Endpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td>GET</td>
<td>/providers</td>
</tr>
<tr>
<td>GET</td>
<td>/providers/{providerId}</td>
</tr>
<tr>
<td>GET</td>
<td>/providers/{providerId}/services</td>
</tr>
<tr>
<td>GET</td>
<td>/providers/{providerId}/services/{serviceId}/resources</td>
</tr>
<tr>
<td>GET</td>
<td>/providers/{providerId}/services/{serviceId}/resources/{resourceId}</td>
</tr>
<tr>
<td>GET</td>
<td>/providers/{providerId}/services/{serviceId}/resources/{resourceId}/GET</td>
</tr>
<tr>
<td>POST</td>
<td>/providers/{providerId}/services/{serviceId}/resources/{resourceId}/SET</td>
</tr>
<tr>
<td>POST</td>
<td>/providers/{providerId}/services/{serviceId}/resources/{resourceId}/ACT</td>
</tr>
<tr>
<td>POST</td>
<td>/providers/{providerId}/services/{serviceId}/resources/{resourceId}/SUBSCRIBE</td>
</tr>
<tr>
<td>POST</td>
<td>/providers/{providerId}/services/{serviceId}/resources/{resourceId}/UNSUBSCRIBE</td>
</tr>
</tbody>
</table>

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smart train station
smart ski station
Smart home
Smart living & well-ageing
Smart city

Kameoka, Maya, Osaka
Chamrousse, PyeongChang

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

PTL
iHouse

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SMART SKIING

The case of Chamrousse

Rémi Druilhe (CEA)
IOT FOR SMART SKI RESORTS

Ski resort staff
Skiing area status service, traffic service, snow quality service

Vacationer
Skiing area status service, entertainment service, skier profiling service

Tourism companies
Entertainment service, skier profiling service

sensiNact

LoRa Weather Station
Position Sensor
Health Sensor
LoRa Signpost
Traffic Sensor
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
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 in 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 a discount voucher for local shops.

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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

- 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 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
Smart Ski Hackathon

Skieur (position, hauteur de descente, carving, sauts, ...)

Cas d’usages innovants

Météo (température, vent, ...)

Station (webcam)
La famille part au ski

Les 2 jours précédents se sont très bien passés.

Piste connectée / gaming

Ils leur départ de domicile, 
sur leur voyage :

VARIOUS OTHER USE CASES

- PC Parking :
  1 place de voiture réservée automatiquement

- PC BUS :
  5 places réservées automatiquement

- PC Loueur :
  5 packs de matériel préparés

- PC office du tourisme :
  5 forfaits achetés automatiquement
  envoi de push promo ou 
ofres du jour personnalisées

PC parking relais : 1 place de voiture est automatiquement réservée

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

+10% par rapport
au week-end précédent

+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

19h rdv restaurant
la pierre chaude

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

WE ARE CREATING A GLOBAL ALLIANCE TO DEFINE THE CITIES OF TOMORROW

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.

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Thank you for your attention!

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