Beacon Südtirol - Alto Adige

FESR-2023

CUP: B31H17000060001

D3.1

State of the Art

Final Report

Authors

Patrick Ohnewein (NOI Techpark)
Stefano Seppi (NOI Techpark)

Indice

1 - Introduction

In the WP 3 "State of the Art" the Beacon project team in cooperation with Fraunhofer Italia and Gruppo FOS:

- analyzed the Internet of Things Market in order to identify: application areas, guidelines and potential for the development of IoT projects for South Tyrolean companies;
- analyzed the Internet of Things Technologies in order to identify current and future technologies, solutions and projects suitable for the South Tyrolean context;

As said before the goal of this activity are:

- the identification of potential application areas for the IoT sector;
- the definition of guidelines that could be used also by the public administration to plan future investment and developments;
- identify interesting project ideas for the development of the South Tyrolean companies and research institutions;
- understand which are the actual IoT technologies on the market and understand its weaknesses and potential;
- identify the most promising actual and future technologies for the South Tyrolean context.

2 - The IoT Market

NOI Techpark with the support of Fraunhofer Italia made an analysis of the Internet of Thing Market which will be taken into consideration for the future strategies and development in this sector.

2.1 - The methodology

For the development of the IoT Market Analysis NOI Techpark and Fraunhofer Italia decided to involve the most important south tyrolean stakeholder active in the IoT sector and the Local IoT community that born during the Beacon South tyrol Project (beacon.bz.it/community/). Moreover for the definition of the Market Analysis also the result of the IoT Technologies analysis where really important for this reason the two teams where strong in contact and met on a regularly base during the whole project.

In order to make a complete IoT Market analysis NOI Techpark and Fraunhofer Italia implemented the following activities:

1. **Analysis of the potential of IoT business in South Tyrol**
   The main results of the analysis aimed at quantifying the number of local stakeholders that can directly or indirectly benefit from the development of projects in the IoT context and analyse their distribution by sector and area of knowledge. The systematic collection of companies and other types of stakeholders allowed the project team to define the characteristics of the IoT network as well as the main sectors and areas of strategic knowledge for the development of innovative local projects.
   With regard to the collection of companies that can benefit at a local level from the introduction of innovative IoT services - either directly or indirectly - the methodology used has taken into account several aspects. As a first filter, the ATECO sectors relating to the so-called Knowledge Intensive Business Services (KIBS) were considered, within which the existence of the largest number of operating and/or potential companies benefiting from IoT technologies, products and services is presumed. Moreover all the companies present at the NOI Techpark and the companies that carried out research and development projects, funded by Provincial Law 14 (LP 14/2006), were also included. Once the list of the potential companies has been identified the following activities where made:
      - a survey has been sent to the whole list of companies identified as potentially interesting;
      - the companies that answered to the survey were contacted by the project team in order to have further feedback and involved in the local IoT community;

- the result of the survey and the feedback of the contacted companies has been analyzed in order to proceed ith the definition of the successive steps.

2. **Analysis of the IoT Project at a local, national and european level**
The analysis of initiatives and projects active in South Tyrol in the IoT sector involved the systematic collection of projects co-funded by the European Commission in a number of significant funding programs for the area at different levels, by expanding the search from the local level (e.g. ERDF) to the international level (e.g. H2020, Life+, etc.). The presentation of these projects provided an overview of the thematic areas and the contents subject of research and development, to be considered to establish synergies for any possible future research developments in the area. Before analysing the results of specific projects, a preliminary research was carried out, aimed at identifying EU funding programs potentially relevant to the issues of the IoT area. This operation made it possible to address the search for projects in this area in a more targeted manner.

3. **Definition of guidelines for the development of innovative ideas in IoT**
One objective of the IoT Market analysis concerns the definition of guidelines supporting the stakeholder of the community in the future development of innovative projects and ideas in the IoT area. In this sense, NOI Techpark and Fraunhofer Italia developed and tested concrete tools to support innovation processes within collaborations between companies, research centres and start-ups.

2.2 - The outputs

The output of the IoT Market analysis where summarized in a White Paper that has been published on the Beacon south Tyrol website. You can download the document at the following link:

beacon.bz.it/wp-3/iotmarket/.

3 - The IoT Technology

NOI Techpark with the support of Gruppo FOS made an analysis of the Internet of Thing Technologies which will be taken into consideration for the future strategies and development in this sector. Moreover this study will provide an overview about the existing IoT technologies and the future developments taking into consideration also the South Tyrolean context. The result of this analysis will be also the starting point for the community in order to understand which technologies will be the most interesting for the local market and innovation development

3.1 - The methodology

For the development of the IoT Technology Analysis NOI Techpark and Gruppo FOS started from the existing literature and, thanks to the involvement of the Local IoT community made a deeper analysis of the most interesting IoT Technologies for the local context. Gruppo FOS and NOI Techpark decided to realize the IoT Technology state of the art analysis in the three different phases described in the following paragraphs.

Phase 1: analysis of the state of the art of actual and future IoT Technologies
The goal of this phase was the development of the analysis of the state of technological art, aimed at identifying the current and future technologies and platforms with regard to the Internet of Things sector at local national and international level. This activity aimed to have a complete overview of the IoT sector and identify the most promising technologies for the South Tyrolean context.

Phase 2: identification of the most promising IoT Technologies
During the second part of the state of the art of the IoT Technologies analysis NOI Techpark and Gruppo FOS made a comparison of the most promising IoT Technologies also taking into consideration the local context. The output of this phase was a list of interesting technologies for the South Tyrolean context.

Phase 3: platform and technology comparison
The main goal of this phase was the validation of hardware and software platforms linked (or possibly linked to) IoT applications, analyzed in Phase 2. The idea was to identify methodologies and tools for design and prototyping that make it easier and more efficient on the one hand the collection, manipulation and transfer of data, on the other hand the visualization and storage of the same data in an IoT context. This phase is the natural conclusion of the previous phase 1 a phase 2. The goal of this phase was the verification of the real potential of the most promising technologies based on the result of real implementations.

3.2 - The outputs

The output of the IoT Market analysis where summarized in a White Paper that has been published on the Beacon south Tyrol website. You can download the documents of the three phases at the following link:

beacon.bz.it/wp-3/iottechnologies/.

4 - Conclusions

The output of the "*WP 3 - State of the art*" are really important in order to define the future strategies and to help the community to identify the most promising sector and technologies in the field of the Internet of Things. In the following paragraphs are summarized the main results and conclusions of the market and technology state of the art analysis.

4.1 - IoT Market

The IoT represents one of the main technologies enabling the fourth industrial revolution. The possibility of connecting every single object to a network, univocally reachable, as well as being integrated in a context of centralized or distributed information systems, will allow the development of technologies, products, services and business models.

The creation of an IoT community at a local level that intends to collaborate in the definition of innovative ideas, can favour the further development and use of this type of technology, increasing the capacity of local stakeholders to generate positive effects on the region. In addition to stakeholders that include representatives from the world of industry, research and public administration, as well as civil society involvement is desirable in order to guide the development of innovative products and services based on market expectations and needs.

In South Tyrol there are numerous opportunities for the application of IoT technologies in sectors and areas that are strategic for the territory such as agriculture, tourism, mobility, services to citizens and public administration, smart-cities, healthcare, manufacturing and construction. Such applications can represent new growth opportunities for local companies, as well as the offer of innovative services with high technical content and know-how in the area.

The systematic collection of projects highlights the wide range of sectors and application areas for the development in the IoT area, potentially transferable according to needs within the context of South Tyrol. The knowledge of previous experiences carried out at a local and international level in the IoT field represents useful information that can facilitate the stakeholders interested in defining innovative projects in strategic sectors.

The results of the survey aimed at defining active South Tyrolean stakeholders or those that can benefit, even indirectly, from the introduction of innovative IoT services shows the existence of a very heterogeneous and synergetic network composed of companies, research centres, start-ups up and public administrations. The profile of the community that the analysis allowed to delineate, can be considered the initial context of competences, to which NOI Techpark will be able to refer in order to foster collaborations for the development

of innovative ideas. Encouraging the creation of such collaborations in the territory can contribute to the development and market introduction of innovative products and services.

4.2. - IoT Technologies

In the technological context, not always the concept of IoT (Internet of Things) and IIoT (Industrial Internet of Things) is not clearly distinguished. Therefore, the vision of the IoT can be consumer or industry oriented. In the consumer-oriented concept the focal points are people, domestic applications, consumer electronic devices, cars, computers and many other commonly used objects. Industry 4.0 (IIoT) instead creates opportunities for companies, production plants or entire sensor networks.

The examination of the various protocols and technologies, which often merge to give rise to a set of specifications and technical characteristics, present at the Network Access Layer level in the IoT panorama, has highlighted a first adjustment for the LWPAN/Cellular Like. In fact, 3GPP[1] has already released all the LTE and NB-IoT specifications, the EC-GSM-IoT remains, which is at version 13, and the national authorities have already made frequencies and test sites available. On the other hand, companies and research centres do not wait for GSM operators and thanks to the various associations and consortia they have given rise to various valid alternatives, first of all noting Sigfox and LoRaWAN.

In the world of WLAN, PAN, ULPW LAN, very targeted and application-related technologies are emerging such as ANT/ANT+, now present on the market for personal fitness and health care gadgets, technologies such as BLE and ZigBee that instead are linked to more broad-spectrum activities are also emerging. ZigBee is more on the industrial and home automation side, where even in these cases there are convergences, as for example is happening between the ZigBee Alliance and the Thread group. The latter products are now becoming part of our homes, in fact many Google NEST Thread products already exist.

In the Session Communication Layer, the situation is in the process of stabilization, the most used protocol is the MQTT that is seeing an evolution from a protocol designed for telemetry to the IoT-oriented protocol. Not to forget the classic protocols of the WEB, among which the adaptation of the XMPP, born for the exchange of messages, but which is also proving to be an excellent protocol for the IoT, and the protocols created to give the entire infrastructure to Messaging systems and designed also in an AI perspective, such as NATS.

Finally, the way of managing and analysing data can boast the presence of a myriad of different systems and platforms. In this analysis, only a few that are not always the most used in the IoT world have been considered, but they are very

---

[1] 3GPP is an umbrella of standards organizations wchich develops protocols for mobile telecomunications (www.3gpp.org).

interesting from a technological point of view. The results have been released in tabular form in the respective chapters.

Another topic addressed was that of the cybersecurity which, with the spread of IoT, is an increasingly central topic. In this sense, a look was given to the intrinsic safety of devices and technologies, trying to grasp the problems. Finally, it is natural to wonder how much the IoT expands the possibilities and methods of intrusion and attack thinking of the spread that the IoT paradigm is having. Think about connecting myriads of devices around the world, extending technology and information systems to physical objects that are different in nature and application. All this has led to a small examination of the fundamental actions to be taken to resolve those that, regardless of the technology itself, may be weak points.

Finally, the situation in South Tyrol shows a diversity of applications linked both to technologies and that require a Gateway to have access to the Internet and technologies directly connected to the Internet. Considering only the latter, we notice an important start on 5G-related technologies, but for now we note only either specific projects or the creation of connection backbones. Moreover, as it is also being structured at national level, 5G will cover mainly large cities or large industrial areas with high density of people or sensors.

The peripheral areas and, in particular, the rural ones, which are important for South Tyrol, will not be the centre of attention. For this reason initiatives like LoRaWAN@NOI are really important in order to test and identify possible alternative solutions suitable for the South Tyrolean context. In this sense NOI Techpark and Eurac Research are working on the development of a first testing area at the NOI Techpark. Also Alperia Fiber is investigating the LoRaWAN technology.