DELIVERABLE

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D5.2 – Tourism Lead and Replication Pilots Reports

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Revision history and statement of originality

Revision history

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1	11-12-2013	Miguel Lemos	Alfamicro	First draft and insertion of reports from Pilots
2	19-12-2013	Miguel Lemos	Alfamicro	Revision of contents and insertion of contributions

Statement of originality:

This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

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1. Introduction

1.1. The CitySDK Tourism API

The CitySDK Tourism API was developed with the aim of enabling the access and distribution of high value open data – provided by the Cities – regarding Points of Interest, Events and Itineraries, in order to allow Developers to create innovative applications and services for tourists and citizens.

The API is part of a toolkit that is designed to support the Cities implementing servers to provide the open data and allow the external access to such data sets. At the same time, the toolkit also provides support tools for Developers, enabling the access and use of the open data, and the integration of the API with applications, either the ones in development as the ones already built.

To provide the adequate support to the activities of both the cities and the developers, the CitySDK Tourism API toolkit provides:

- CitySDK Tourism API,
- A Server Reference Implementation, with instructions for setting up the server and populating the database;
- Libraries for Developers in Java, Javascript, PHP and Objective-C;
- Demonstration applications and web-widgets.
- Access to the endpoints of the replication cities.

1.2. Replication process

Ensuring the interoperability of the apps among different cities is the most ambitious outcome of the whole CitySDK project. Therefore, to test and demonstrate the CitySDK Tourism API fulfilled this requirement, Replication Pilots were implemented in four European Cities: Amsterdam, Helsinki, Lamia and Rome.

In each of these pilots, servers were implemented by the cities following the guidelines and instructions included in the toolkit. In some cases, this process required the development of data adapters to ensure the data was organised and readable by the CitySDK Tourism Engine, instead of re-writing all the data in the proper format. This approach saved time and resources, proving to be feasible, safe and efficient.

As a result of the server implementation, each city became able to provide its own endpoint for the CitySDK Tourism API, allowing the access to the data available in the city by the applications created by developers. A directory service is being developed to facilitate the process of identification of the available endpoints, allowing applications to automatically identify which endpoints are near and which data is provided in each city.

1.3. Structure of the document

This document presents the activities performed regarding the implementation of the CitySDK Tourism API in the Lead and Replication Pilots, as well as the continuous development of the service by introducing improvements and features, and correcting bugs. The support provided to the Replication pilots and the activities carried out to engage stakeholders – Developers, Cities and Users – are also covered in this document.

Considering the above, Section 2 introduces a brief overview on the activities developed as a whole, by all the pilots, providing a framework to the efforts described further in detail on the following sections.

Section 3 describes the activities performed in the city of Lisbon, as the Lead Pilot, as well as the development and improvements achieved in the API, since Deliverable 5.1. The section covers the implementation process in Lisbon, the engagement activities, the impact achieved and the future work to be carried out in the next months.

The activities carried out in the Replication Pilots – Amsterdam, Helsinki, Lamia and Rome – are reported in Sections 4 to 7, respectively, including the implementation and engagement activities, impact achieved and next steps to be performed.

Finally, Section 8 summarizes the main conclusions of the work done regarding the implementation of the CitySDK Tourism API in the all the pilots.

2. Activities overview

2.1. Implementation and support activities

Once the requirements and architecture for the CitySDK Tourism API were defined, in Deliverable D5.1 – "Tourism Pilot Application and its SDK Componets", the team in the Lead Pilot started to work on the implementation of the API, as well as in the support documentation and demonstration applications. As a result of such activities, the servers for the API were installed in the Municipality's department for ICT, with the support of ISA and Alfamicro, whilen IST prepared the endpoint for the API, presented through a website that would become the main interface for the Tourism domain. IST also developed demonstration applications, including an app for Android and web widgets for data visualisation.

As soon as the implementation in the Lead Pilot was ready, as the support documentation, the Replication Pilots started implementing their own servers and endpoints. Lamia, Rome, Amsterdam and, at last, Helsinki, implemented the CitySDK Tourism API endpoints with the support of the team from the Lead Pilot. Along with the implementation, some of these pilots also prepared demonstration applications and websites to act as an interface with the developers and facilitate the support activities.

2.2. Engagement activities

CitySDK aims at providing tools, thus delivering such tools to the people who will use them is a key activity of the project. Considering the purpose of the toolkit developed by the CitySDK, both the representatives from the Cities and the Developers are the two main audiences to be engaged by the project.

In terms of engaging cities to adopt and implement the CitySDK Tourism API, an effort to reach cities at national and international level was performed by the teams of all pilots involved in the WP5. By presenting the project and the tools created for the Tourism domain, as well as they own use case, the teams were able to reach and engage cities beyond the ones already involved in the consortium of the project. It is expected to have some of these cities actively engaged in the implementation of the CitySDK Tourism API until the end of the project.

Regarding the developers engagement, all the pilot teams promoted and participated in events oriented or organised by local developers communities. As a result of this effort, it was possible to collect feedback about the CitySDK API and the data available. Independent developers are starting to use the API to create mobile applicatins, such as Spot-in-Lisbon.

3. Lead Pilot: Lisbon

3.1. Implementation activities

3.1.1. Implementation of the Tourism API

The implementation of the Tourism API was performed in two distinct phases. The first phase implementation consisted on an implementation on a controlled testing environment; the second phase consisted on the migration of the server implementation to the production environment, open for the general public usage.

In the first phase, a pre-production instance of the server was used in ISA's premises. This server used real data fetched from Lisbon Municipality and its main objective was to identify most of the implementation errors and bugs. This server was available to a limiter beta testing team composed by ISA, IST, Alfamicro and CML elements, who used the API with testing applications. As result of this phase, a production version of the server was fully ready for deployment on the next phase, available to the general public. In this phase, a virtual machine instance running a Microsoft Windows Server 2012 was used. Despite of not being actively used after the second phase was initiated, this server instance is still in use for staging when new functionalities or bugfixes are implemented on the Tourism API so that the quality of the each one of the released Tourism API versions is assured before the version is published to the public.

For the second phase, the production version of the server resulted from the previous phase was deployed on Lisbon municipality's servers and was made available to the public. This server instance was deployed on the main web server machine of Lisbon's municipality, which is a Microsoft Windows Server 2012 based machine. The domain name tourism.citysdk.cm-lisboa.pt was created and pointed to the server instance through the http protocol TCP port 80. For populating the server with the points of interest, events and itineraries of Lisbon City, an importer service (a windows service) was also deployed on this machine. This service collects information from the municipality's databases, adapts the information to the CitySDK format and inserts it in the CitySDK server instance. The service runs once a day and adds the new elements found in the municipality's databases and updates the already existent information elements if needed. Figure 3.1 depicts the server deployment scenario of the Lisbon CitySDK API.

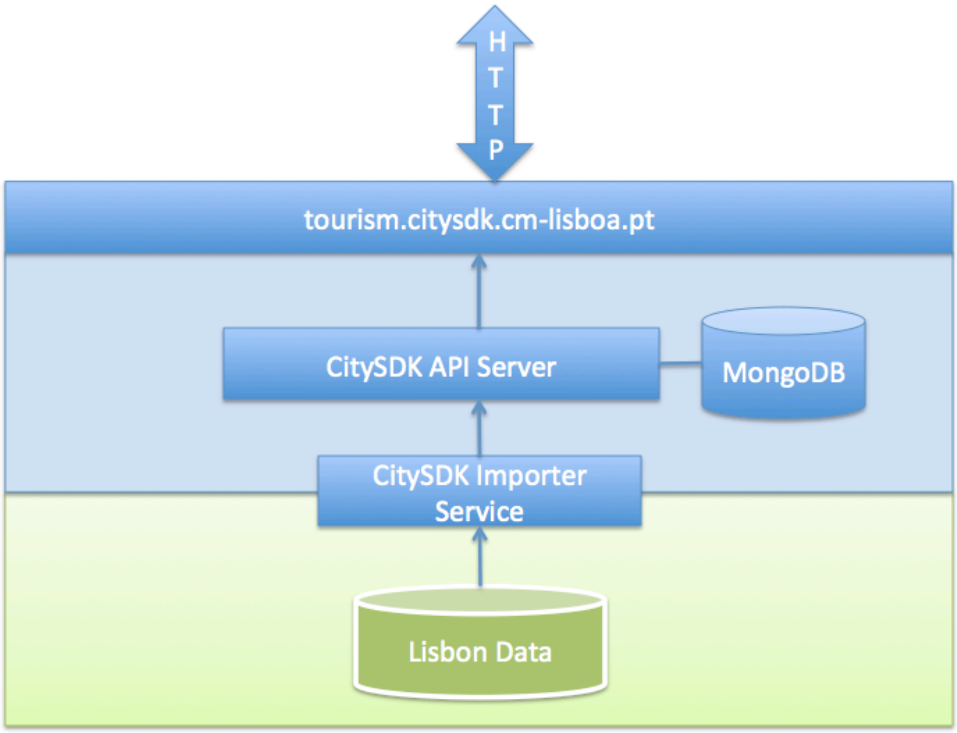

Figure 3.1 - Lisbon CitySDK API Deployment Scenario

3.1.2. Tourism API development and improvement

The first version of the Tourism API was developed having in account the requirements specified in CitySDK Deliverable D5.1. The development environment consists of a Microsoft Visual Studio 2010 Professional running on a standard Microsoft Windows 7 Professional operating system. In order to develop the API, some additional open-source libraries/frameworks were also used:

- Service Stack Framework – A web services framework capable of providing the needed functions to implement the REST web service of the CitySDK API. This framework also provides, among others, the specified JSON content formatting.
- MongoDB C# Driver – The library used to interact with the MongoDB database where the data elements of the CitySDK API are stored.
- SharpKML – A library used by the Lisbon importer to load the city and parishes limits from the KML files provided by the Lisbon municipality.
- DDay.iCal – An iCalendar class library written in C# and based on the RFC 2445 standard. It parses files in the iCalendar format and provides an object-oriented interface to iCalendar components: Event, Todo, TimeZone, Journal, FreeBusy, and Alarm.

After the first version was deployed in a pre-production environment, the interaction with the first demonstration application prototypes starter. Through this interaction, along with the

identification of implantation bugs, a series of improvements were also identified for implementation on the following API versions. Similar procedures were taken on the following versions, resulting in the enhancement of the platform reliability and developer-friendliness for maximizing the acceptance of the CitySDK API by the developers during the next production phase. This cyclic process is still running, being in the current phase also open to third party developers (i.e. non CitySDK team developers) feedback. A public forum and mailing list were created for receiving contributions and suggestions from the developers using the API.

During the replication phase of the API the contributions of the replication pilots also provided a valuable feedback for the enhancement of the Tourism API reliability and bugfixing, resulting in an improved reference server.

In order to extend the scope of the Tourism API and cover cities and regions not considered in any of the CitySDK pilots, a OpenStreetMaps data importer was also developed, capable of reading the amenities on the OpenStreetMaps, converting them into CitySDK points of interest and committing to a CitySDK Tourism API instance.

Also, a directory service for the Tourism API instance was implemented, capable of directing/delegating requester applications to an available server that covers a specific location. As this directory server makes use of the native Tourism API functions and formats, no additional libraries or protocols need to be used by the applications to use this service.

3.1.3. Demonstration applications

Starting at the same time as the implementation of the API server for Lisbon, various demonstrations applications were developed. This effort is still ongoing. The applications are meant for showcasing the benefits of the Tourism API to prospective adopters, be them developers, cities or other participants of the value chain. These applications also serve as a valuable resource for developers, as they demonstrate the use of the API and their source code is available for developers to study. Even though these applications will be distributed and may prove useful to tourists, they are not primarily targeted at tourists.

Several criteria were taken into account when designing the applications: use of several platforms, coverage of the Tourism API, demonstration value and general usefulness. With this in mind, the following applications were created or are currently being worked on: Android Mobile Guide, Layar CitySDK Tourism layer, Calendar Web Widget, Map Web Widget and IOS POI Browser.

Android Mobile Guide

The Android Mobile Guide is a full featured application for the Android Mobile platform which integrates with Google Maps. It enables the user to visualize POI, Event and Itinerary

information either in a list or a map. The user is able to select the type of information he wishes to search for: POI, Events or Itineraries. For each type he can narrow the search using categories, tags, search for keywords in the name or description, and geographic position. The user is then able to learn about the details of each element (POI, Event or Itinerary), which usually comprise, depending on what is provided by the server, a name, description, contacts, images and links to websites. When made available by the server, this application is capable of selecting the adequate language for displaying names and descriptions to the user. Users may also use the mobile device's camera to search for information using QR codes.

Being this the most flexible and complete application, and the most used in demonstrations, we are currently already working on a second version of the application.

The Mobile Guide is written in Java using the Android SDK. The Java client library was an offspring of the Mobile Guide development effort.

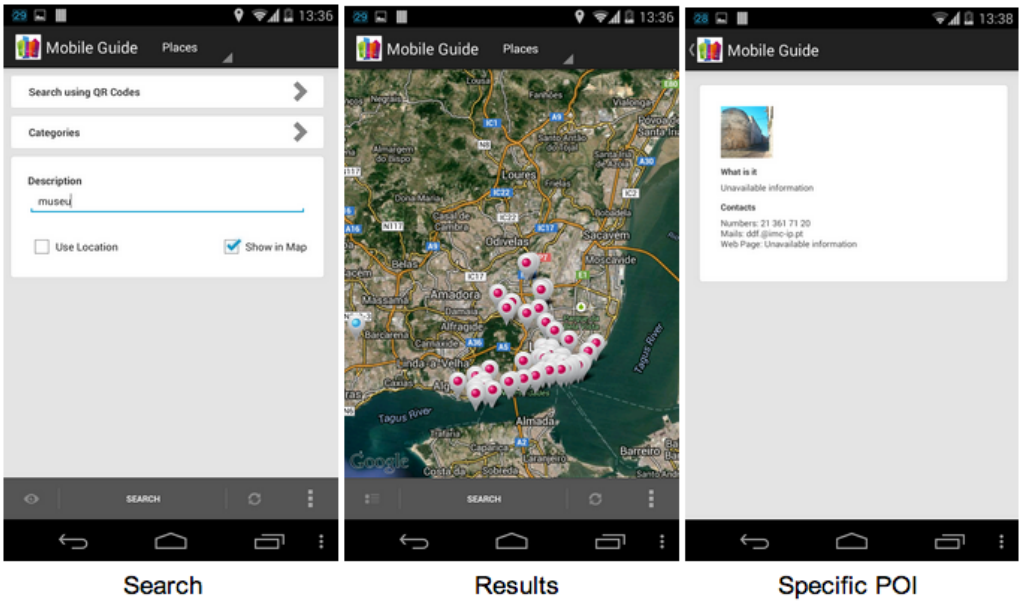

Figure 3.2 – Screenshots of the first version of the demonstration app for Android

The second version of the application, currently under development, has the new Google Maps for Android v2, allowing us to bring a better user experience, for example new touch gestures that are now standard in Android, as well as discarding the third-party libraries used for the map view. For the application navigation and presentation we used the new Android standard, NavigationDrawer. This standard allows the user to access a set of options with one click only, for example, switching between the map and the list view and selecting which type of resource to be presented (POI/event/itinerary). With this new version, the user can select the category from the menu he wants to search and the application will automatically search for the coordinates that are bound to the Google Maps' window currently shown on the device's screen.

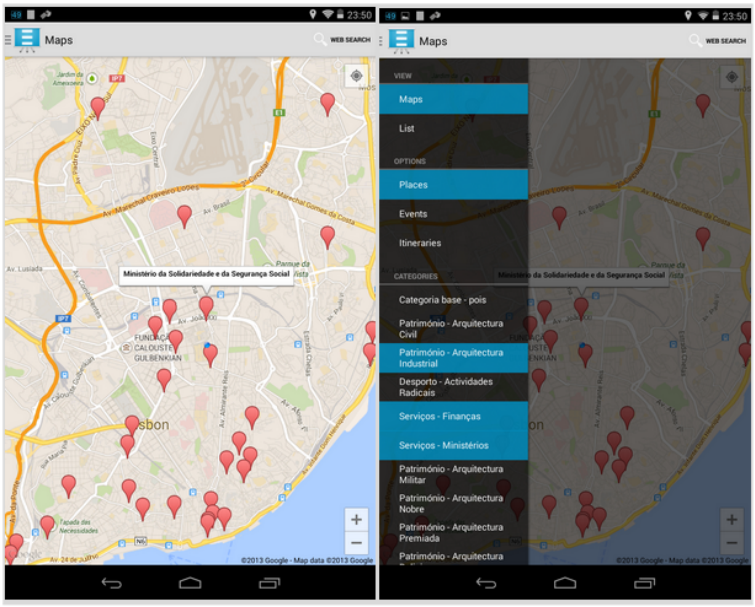

Figure 3.3 - Screenshots of the first version of the demonstration app for Android

Layar CitySDK Tourism layer

Augmented reality is a very useful tool for displaying tourism information, especially in unknown urban environments, where it is easy for a tourist to lose his bearings. We have thus decided to make available a CitySDK Tourism layer for the Layar application. As Layar is available on both Android and IOS, this enabled us to reach the two most popular platforms through a single development effort.

The CitySDK layer presents information on POI within the vicinity of the user. Layar displays a circle for each POI within the defined search radius. The size of the circle is inversely proportional to the distance to the POI. These circles are superimposed on the video image captured by the device back camera, thus providing an augmented reality view of the surroundings.

Layar obtains the information it requires from a server hosted at IST. This server was implemented using PHP, being the first application to use the PHP client library. The PHP server acts as a client to the CitySDK Tourism API, in fact acting as a proxy/translator between the API and Layar.

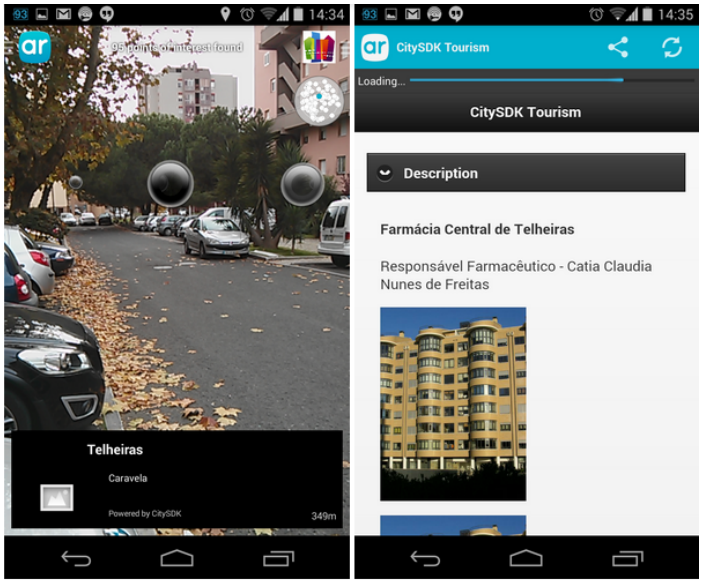

Figure 3.4 - Screenshots of POIs provided by the CitySDK in the application Layar

Calendar Web Widget

The Calendar Web Widget displays Event information on a webpage. This self-contained code is written in HTML and JavaScript, using the JavaScript client library. It interacts directly with a CitySDK Tourism server, not requiring additional server infrastructure. It can be hosted on a Webserver capable of only hosting static content or be part of a downloadable off-line web app (as long as it can reach the CitySDK Tourism server).

The Web Widget displays a calendar where days with events are highlighted. Upon clicking on a day, the details of events for that day are displayed along with any available images. The user uses a pull-down list to select the categories of event to display.

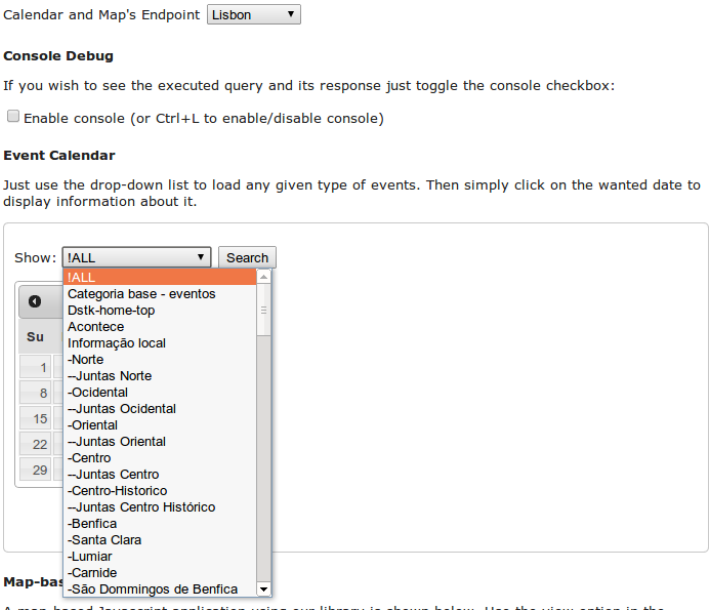

Figure 3.5 – Screenshot of the calendar web widget

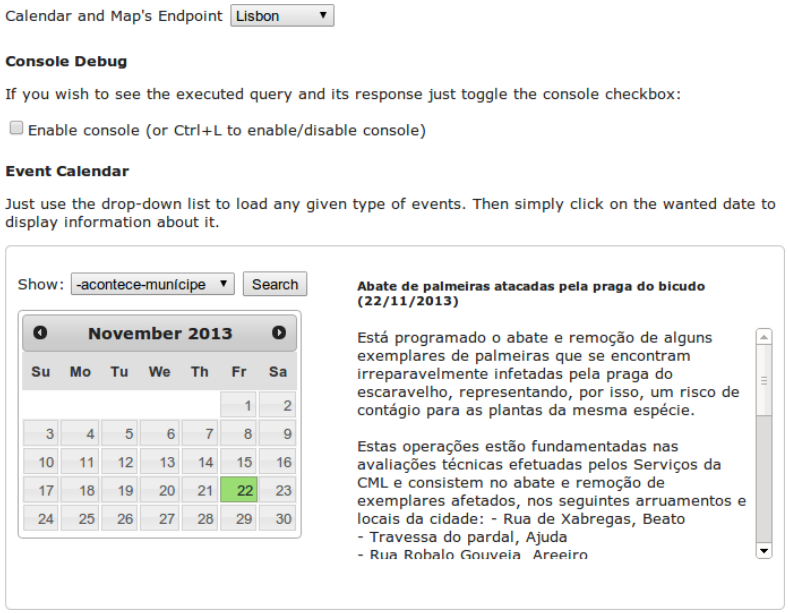

Figure 3.6 - Screenshot of the calendar web widget, with description of an event

Map Web Widget

The Web Widget is based around a map using the Google Maps JavaScript API. Like the Calendar WebWidget, it also relies on the JavaScript Client Library. This is the most complete application after the Android Mobile Guide. It enables Website visitors to search for POI, Event and Itinerary information on a map using geographic shapes.

The interface enables the user to draw geometric figures over a map. These may be circles, squares or any multipoint polygon. Given a shape, the Web Widget queries the selected CitySDK Tourism Server for elements within that area. The user can then move around the map and select an element to learn more information about it. The displayed elements will be POI, Events or Itineraries, according to the user's selection. In areas with high density of elements, clustering is used to reduce the number of elements in the map.

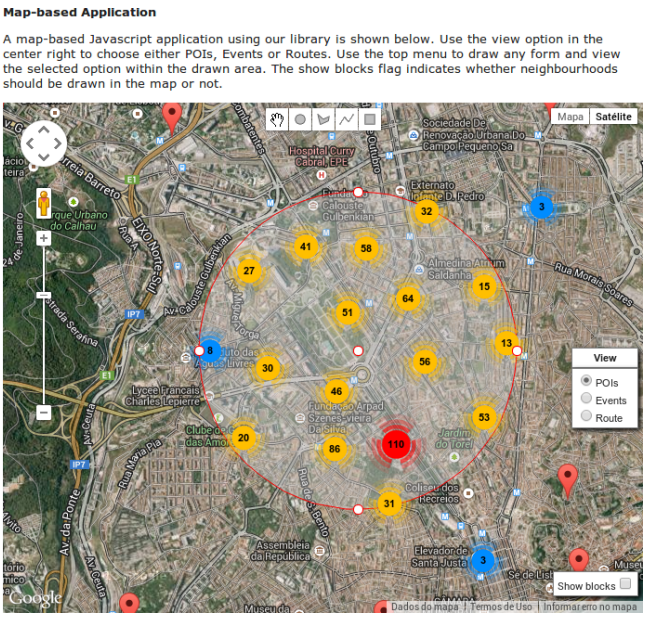

Figure 3.7 – Screenshot of a search in the Map Web Widget

Figure 3.8 – Screenshot of a detailed view in the Map Web Widget

Both Web Widgets are user configurable to operate with the different known CitySDK Tourism API implementation. These also operate as valuable debugging tools for CitySDK Tourism API deployments, as they provide a console interface, which enables exchanged messages to be analysed. This console is a very valuable tool for developers, as it enables them to visualize, in real time, the queries performed and the replies received by both Web Widgets, even allowing them to modify them. This is a very useful tool for learning about the CitySDK Tourism API.

Figure 3.9 – Screenshot of the console interface

IOS POI Browser

The POI Browser is an IOS application intended mostly for use in large screen devices (iPad). It enables users to browse through a mash up of images from related POIs in order to learn about interesting POI in a city. This application is still under development and has not yet been made public.

The IST team was responsible for the design, development and maintenance of these applications, which are displayed on the CitySDK Tourism API Website. The Web Widgets' source code is available on the same website. The other applications' source code is published to Github[1] as soon as they reach a sufficiently mature state.

3.1.4. Libraries for developers

One of the goals of CitySDK is to lower the costs for the creation of applications which use open data made available by the project. This goal is mainly achieved by providing a common API for accessing open data from several cities. However, the cost of application development can be further reduced by providing development tools which provide functionality required by all or most of the applications to be created. In the Tourism Lead Pilot we have made available 4 different client libraries for the Tourism API, for those many different programming languages: Java, Objective-C, PHP and Javascript.

Java

The Java client library serves the broader audience. Java is used on the Android mobile platform, can be used for developing server side components (e.g. J2EE) or desktop applications, thus covering most platforms.

[1] https://github.com/CitySDK

Objective-C

The Objective-C client library was created to facilitate the development of IOS applications (e.g. for the iPad or iPhone). However, it can also be used in the development of OSX desktop or server applications.

JavaScript

As browsers grow ever more capable, rich client side application are now capable of providing complex interfaces and local processing using JavaScript. The JavaScript client library facilitates the creation of rich web apps which communicate directly with the CitySDK Tourism API servers, enabling small developers to do without heavier server infrastructure for web apps with fewer users.

PHP

For developers building web apps were most of the complexity is dealt with by the webserver, PHP is often the first choice of programming language. It is part of the frequently used LAMP (Linux + Apache + MySQL + PHP) infrastructure and is ubiquitously available in hosting providers, even in the cheaper shared hosting plans. The PHP client library is thus aimed at these developers.

While it would be impossible to create client libraries for all the programming languages, we believe these 4 languages cover a very significant part of the developers. Furthermore, the availability of the source code will facilitate the development or porting of the client libraries to other languages.

These client libraries were developed by the IST team in conjunction with the creation of the demonstration applications. They also serve as source code examples of the utilization of the Tourism API. The client libraries have been made available on Github[2]. We are already aware of the utilization of the Java client library in two other applications published on the Android Play Store: the “Tour Guide” for Lamia, created by the Lamia Replication Pilot[3]; and the “Spot-in-Lisbon”[4], developed by Finish independent developers.

Each API is divided in five modules:

- Requests - responsible for creating an abstract layer between the high level requests and HTTP specification. This means that the developer does not have to handle the network logic in his application by using our API, and can retrieve information with only one code line.

[2] https://github.com/CitySDK
[3] https://play.google.com/store/apps/details?id=com.smarts.tourguide
[4] https://play.google.com/store/apps/details?id=in.spotinlis

- Parsers - we developed the parsers needed to transform the raw data retrieved from the API to domain's specification. We used Google's library Gson that converts Java Objects to JSON and JSON strings to Java Objects.
- Domain - the internal representation of API's concepts and the relationship between them. For example, defines how the POI's properties are represented internally and its relation with other domain object, for example Geometry, thus it is possible to define if a POI has a point or a polygon as its location.
- Terms - responsible for keeping all the terms used by the API and delivering them to the client, in order to avoid misspelling errors when making the requests.
- Exceptions - a set of error descriptions that are triggered when something goes wrong. With this approach the developer can easily find what causes the error using its description and fix it.

3.1.5. Available data sets

A wide range of POIs is made available through the Lisbon CitySDK platform. These POIs are imported from the municipality's internal GIS server and contains around 4000 distinct points distributed among several categories such as:

- Restaurants;
- Hotels;
- General services;
- Sports facilities such as swimming pools, stadiums, golf places;
- Architectural patrimony;
- Museums, libraries, cinemas, theaters and other cultural facilities;
- Monuments and historical patrimony;
- Religious places;
- Health facilities;
- Shopping centers, markers, fairs and other commercial places;
- Educational facilities (Universities, Schools and others);
- Transport related POIs (bus stops, metro stations, parking lots and others);
- Gardens and playgrounds;
- Sightseeing places;
- Campsites;
- General touristic POIs;
- Nightlife;

Information about the city and the several Lisbon's parishes limits is also available in the CitySDK platform. This information is imported by the CitySDK importer service from KML files supplied by the municipality's territorial ornament department.

Events made available in the platform are retrieved from a central database that also supplies information for the municipality's website. Most of the events available on this database have links (via a unique id) to the POIs available on the municipality's GIS server, from where the CitySDK POIs are loaded. For the events where this link is available, it is possible to establish inside the CitySDK platform a relationship of the events to the specific place (POI) where the event happens. Currently, Lisbon makes available more than 1300 events in the CitySDK platform spread across several categories such as:

- Expositions;
- Music events;
- Dance;
- Theater;
- Fairs and Fests;
- Religious events;
- Cinema;
- Arts
- Congresses and Workshops;

Touristic itineraries available in the Lisbon CitySDK platform are supplied by the Municipality via a textual document and integrated manually in the importer service. The textual document contains, for each one of the itineraries, a general description and name of the itinerary and a set of POIs. Each one of the POIs that compose the itinerary must be linked to a existing POI and may have optionally a contextual description in the scope of the itinerary. This way the applications may supply to the user information about the points that compose the itinerary and an additional context or description of the points that only make sense in the context of the itinerary. At the moment Lisbon publishes 3 distinct touristic itineraries.

The Municipality of Lisbon also presents these data sets through the portal Lisboa Participa, allowing a quick overview of the available data sets. The datasets available on Lisboa Participa[5] are not exclusive from the municipality; within it it's possible to find datasets from governmental agencies, tourism partners and other relevant institutions.

[5] Lisbon Participation Portal, where the open data is hosted - http://www.lisboaparticipa.pt/

Picture 1 - Lisboa Participa - Open Data

Tourism related datasets, and those under the full control of the Municipality can be found in http://digc.cm-lisboa.pt/DIGC/rest/services/OpenDataLX/LxPOI/MapServer, all the others (and this one's also) can be accessed in http://www.lisboaparticipa.pt/pages/newApps.php.

3.1.6. Support to Replication Pilots

A website dedicated to the domain of Tourism in CitySDK[6], was created to provide support to the replication pilots and developers, being organised in three parts:

- Documentation, that includes "Home" and "API", where the developer can get more information about the system's architecture. We also provide the API specification, details, and present some examples of how to use the API. This information is crucial for developing an application that uses Tourism's CitySDK API.
- Resources, including the libraries, applications and the reference server. The library section is divided by the programming language, which has the source code and documentation links, and presents examples of how to use the libraries. This section also has an available demonstration and third-party applications. For each application there is a small description and installation links. This part also has the reference server information to allow a developer to have his own server, making it possible to control all the information and not be dependent in other's servers.
- Communication, includes the information of all the Tourism CitySDK's partners as well as a forum and a mailing list for facilitating the communication between the

[6] http://citysdk.ist.utl.pt/

developers, clients and the project owners, providing more information and helping solving problems and also get feedback from the stakeholders.

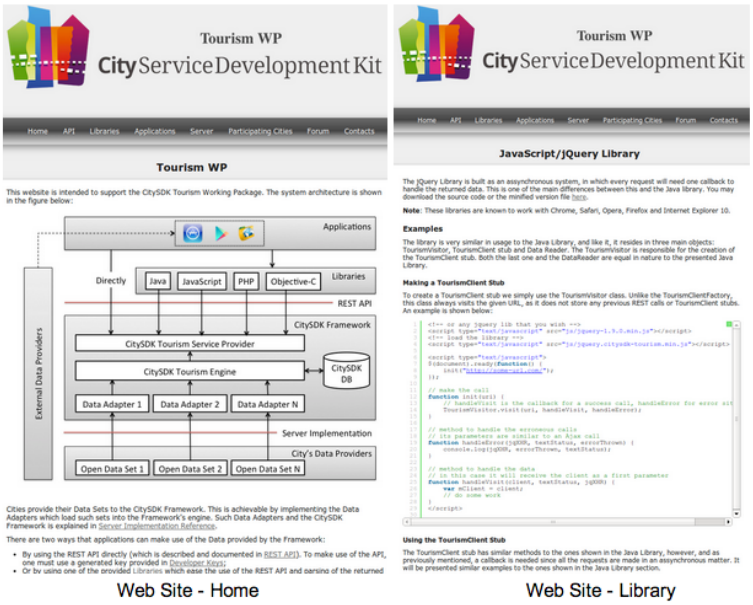

Figure 3.10 – Screenshot of the CitySDK Tourism website

Several teleconferences were also performed with each one of the replication pilots at key moments of the process to provide instructions, assistance and track the replication implementation process to assure the success of the replication tasks of each one of the pilot responsible and technical teams. Direct email channel was also used continuously to clarify or solve any detected issues from the replication pilots in the process.

3.2. Engagement and impact

3.2.1. Engagement activities

Meet-ups

In order to ensure a successful engagement of developers, the Pilot Team has exploring the local communities of developers, by contacting the organizers of regular meet-ups for developers. Our goal has been to approach these communities and participate in their meet-ups, where they already feel comfortable, to present CitySDK and engage them to use and test the toolkit provided by the project.

Developers privilege a trustful relationship with someone from the project that can swiftly solve problems and clarify any doubts. The communication with developers has been mostly done through a first contact with the meet-up group, followed by presentations and face-to-face contact during the events. From that point on, the contact is mostly done by direct contact via e-mail and face-to-face meetings.

Figure 3.11 – CitySDK at a meet-up of PHP developer's

Apps Competition

Lisbon Big Apps, is an app contest that took place between March and June of 2013, being promoted by the Municipality of Lisbon with the support of a major telecommunications operator. The event had more than 200 participants. The CitySDK and the open data sets of the Municipality of Lisbon were presented as tools at the disposal of the Developers.

The 2014 edition of the competition is already being prepared and it will include adjustments to the concept of the event. In order to feature CitySDK toolkit and engage more developers, a special prize category will be created for applications that use the CitySDK Tourism API to create innovative applications and services.

Between the meet-ups and the Lisbon Big Apps contest, we have reached already more than 300 developers. Nevertheless, we are aiming to increase this number with the next event of Big Apps, the participation in more meet-ups and the possibility of doing a Road Show through local incubators, to reach technological start-ups.

Other cities and organisations

The pilot team has been developing contacts with other Portuguese cities and organisations, in order to promote the project and engage them to use the CitySDK Tourism API. Recently, the Municipality of Oporto, the 2nd largest city in Portugal, has demonstrated great interest in opening its data and it is exploring solutions and models adopted in other cities. The pilot team, through the Municipality of Lisbon, is establishing contacts with the aim of promoting the CitySDK Tourism API and providing support for its implementation by the City of Oporto.

The Municipality of Lisbon is also establishing contacts with central administration organisms, such as the Agency for the Administrative Modernization, which is responsible for the modernization process of the public administration as well as for the management and providence of open data sets at national level.

3.2.2. Impact

Benefits of Open Data

The Open Data importance is quickly increasing in the strategy of turning Lisbon into a Human Smart City. This concept, launched by Prof. Álvaro Oliveira, CEO of Alfamicro, promotes a city where information and communication technologies are not only used to solve technical problems and improve the efficiency of the city's systems, but also to enable societal changes by providing solutions to engage the citizens and facilitate the co-design and co-creation of open user-driven innovation on urban ecosystems. In fact, Open Data is one of the cornerstones of such concept, by fostering the transparency of the data held by the city, as the access to it by Developers and Citizens, enabling the usage of the data to create innovative applications and services that can generate a positive impact in the local economy while improving the quality of life in the city.

The Municipality of Lisbon is committed with this vision and is developing strategies, which have their foundations in the Open Data. The integration with the technologies that are coming from the Future Internet Public-Private-Partnership, in particular the FI-WARE platform, and the generic and specific enablers, is just an example of the possibilities that result from the decision of openning the data that is held by the Municipality.

The development and implementation of the CitySDK Tourism API also allows the creation of new forms of collaboration between the Municipality and the parishes. Initiatives as the CIP Project MyNeighbourhood, which aims at promoting societal transformation by using ICT solutions to revive the lost sense of community in the typical neighbourhoods of the modern cities, will also benefit from of the Open Data and the CitySDK Tourism API. On one hand, the parishes and neighbourhoods can provide data with higher level of granularity, which enriches the overall pool of open data in the city. On the other hand, the citizens of such parishes can benefit of the services created based on the data provided, along with the boost generated by the touristic activities in the local economy.

Project communication

In terms of communication, the pilot team has been communicating the project and the API through different channels, such as:

- CitySDK blog: activities and main achievements of the Lisbon pilot have been communicated through the official blog of the project.
- Facebook: a page dedicated to the Lisbon pilot was created to communicate the activities carried out by the team of the pilot and support the engagement of developers.
- Lisboa Magazine: an article describing the project and the CitySDK Tourism API is prepared and will be published in the edition of January 2014.

- Presenting the CitySDK Tourism API to representatives of European cities, in a meeting of the EuroCities network, which took place at Manchester, in October 2013.

3.3. Next steps

Although Tasks 5.1 and 5.2 are already due, the team of the pilot will keep performing improvement and maintenance activities, to ensure the CitySDK Tourism API will keep evolving, as well as engagement activities to promote the toolkit to Cities and Developers.

Implementation of directory server

A directory service is being developed to incorporate all the main endpoints in one server, allowing to automatically obtaining the endpoint URL in which it can retrieve the information for the corresponding user's position.

Launching of more apps

A second verstion of the Android application, Mobile Guide v2, is being currently developed. This application will be available in Google Play. The source code will be available on GitHub. In the application there will be two view types: map and list view. Right after the user starts the application, it will present some information about places around him. The user can navigate in the map to discover new POIs, events or routes or he can use the search option, which enables searching for a specific name, for example.

The Mobile Guide v2 will integrate the Open311 standard in order to report problems with POIs, events or routes. The problems can be, for example, missing or wrong information, or missing translation. By doing this, we provide a crowdsourcing mechanism to report the problem, as well as a way for users to contribute with corrections to improve data quality.

Contact developers with apps in the markets

There are already several applications providing services for Tourism in Lisbon, which are available in the main app's markets: Google Play, App Store, etc. The pilot team will benchmark these applications and contact the correspondent developing teams, to inform about and promote the integration of the CitySDK Tourism API.

Improve data quality

The Municipality of Lisbon is committed with the sustainability of the CitySDK Tourism API after the end of the project. Thus, the data sets available will be continuously improved, including regular update of the data, translation to English, validation of coordinates, etc.

Lisbon Big Apps

CitySDK will be present in the Lisbon Big Apps, an app contest launched by the Municipality of Lisba, as a co-organiser of the event. A special prize category will be created to award the best applications built to provide services using of the CitySDK Tourism API.

Start-ups Roadshow

The project team will prepara a short roadshow through the main incubators in Lisbon to promote the CitySDK project and toolkit to start-ups and SMEs that are developing applications to provide touristic services.

Hackaton BlackBerry IST

BlackBerry is preparing a series of events and hackatons in Portugal to promote the new platforms and devices. The pilot team has established contacts with the aim of organising a hackaton with the support of the brand as a way to reach and engage developers to use the CitySDK Tourism API.

Engagement of other cities and public organisations

The pilot team will keep promoting the CitySDK project and toolkit to other cities and public organizations to foster the adoption and use of the tools provided by the project, increasing the network of cities using the CitySDK Tourism API. Cities such Oporto and Setúbal already demonstrated interest in using the CitySDK toolkit to provide open data. Moreover, public organizations with responsibilities related with Open Data at national level have been contacted to be aware of the project and explore possible integration, including the Agency for the Modernization of the Administration and the Entity for the Shared Services of the Public Administration.

4. Replication Pilot: Amsterdam

4.1. Implementation activities

4.1.1. Implementation of the Tourism API

For the deployment of the tourism API, a server was setup at University internally. The server runs on a 64 bit Microsoft Windows Server 2008 R2 platform, Internet Information Services 7.5 and Microsoft .Net 4.5 Framework. Ports 80 and 443 were made accessible for outside requests to the API. For the various available data sets (see Section 4.1.2) data adapters were written to make sure that it met the formatting requirements for the CitySDK. The API endpoint is available at http://citysdk.dmci.hva.nl/CitySDK/resources.

Besides the standard API requirements (points of interests, events and routes (see Section 4.1.2), extra data was added in the form of dynamic sensor data. In collaboration with the Van Gogh Museum, a sensor system that is able to measure the current waiting time is created. The created sensor system is further explained in Section 4.1.3. To show the possibilities of open data in the CitySDK, the following demonstration applications were developed by the pilot team.

Mapviewer[7]

A web widget was created to show a overview of the data that is currently in the CitySDK plotted on a map. It uses the CitySDK tourism JavaScript library to retrieve this data. Developers can use this map viewer to see a working example of retrieving and plotting the data from the platform. Users are able to plot POI, events or routes on the map, as described in Figure 4.1.

[7] http://citysdk.dmci.hva.nl/map

Figure 4.1 – Screenshot of the POIs visualisation in Amsterdam

Mobile application

A mobile application for Android was created to highlight the possibilities of dynamic sensor data. The application loads the Points Of Interests (POI), events and itineraries that are available in the CitySDK and lets users select the places or events they want to go, or a predefined itinerary. Based on the input of the users, and taking into account the dynamic sensor data with regards to the waiting time at the selected places, a most efficient route is calculated and shown to the user, as presented in Figure 4.2.

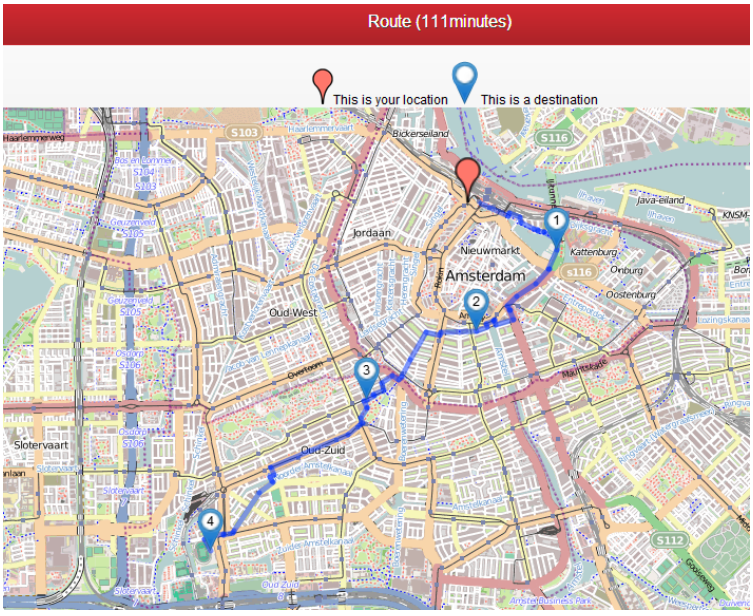

Figure 4.2 - Screenshot of the Itinerary visualisation in Amsterdam

Also, users have the option to retrieve more extensive information about the waiting time at a selected location. Users can be shown a graph with the predicted best time to visit that

location based on historical sensor data. Besides this information, recommendations are made of POI or upcoming events in the vicinity of the selected location, as described in Figure 4.3.

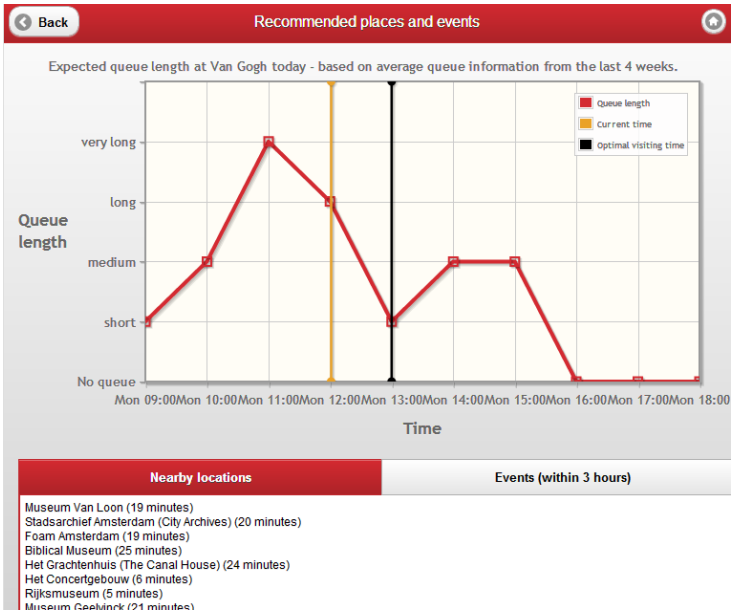

Figure 4.3 – Screenshot of the mobile application for queue length and waiting time

4.1.2. Data sets

POI/Events (Artsholland)

The 201 POIs - mainly museums, theatres or music venues -, and cultural events that are available in the CitySDK are imported from the Artsholland[8] platform. The Artsholland platform already has an API, but its data is not available in the European wide CitySDK standard. Each event in the CitySDK is linked to a POI in which the event will be taking place.

Hotels

This dataset originates from the amsterdamopendata.nl platform. This platform is a database of all existing open data sources in Amsterdam. Downside of this platform is that the data is in different formats and there is no API available. This hotel data consists of information such as: address, name, star rating and number of rooms and beds. In the data adapter, the address is turned into geo-coordinates using geocoding.

Restaurants

This dataset also originates from the amsterdamopendata.nl platform. This dataset consists of information such as: Name, short description, long description and opening time information. This information is available in both Dutch and English. Besides this, there is also information about the location (address, geo-coordinates), the website, and URL to media data in the form of pictures.

Itineraries

Itineraries are retrieved from Iamsterdam.com. In the future, we want to expand the itineraries in a way that the users themselves can create their own itineraries.

4.1.3. Applications and services

We have used a custom sensor system that is based on the Arduino framework. This system is able to detect if someone stands at the queue at the van Gogh museum. The data generated by these sensors, containing the distance in cm to the closest object and the number of the sensor, is sent to the base station. This base station is located inside the museum, which detects the sensor signal with an external antenna. This base station is connected to the Internet via Wi-Fi, which enables it to send the raw sensory data to a separate server. This server stores this data in a MySQL database. A data adapter sends the most recent data to CitySDK API, which is than able to show the waiting time at a particular tourist hotspot.

[8] http://www.artsholland.com/

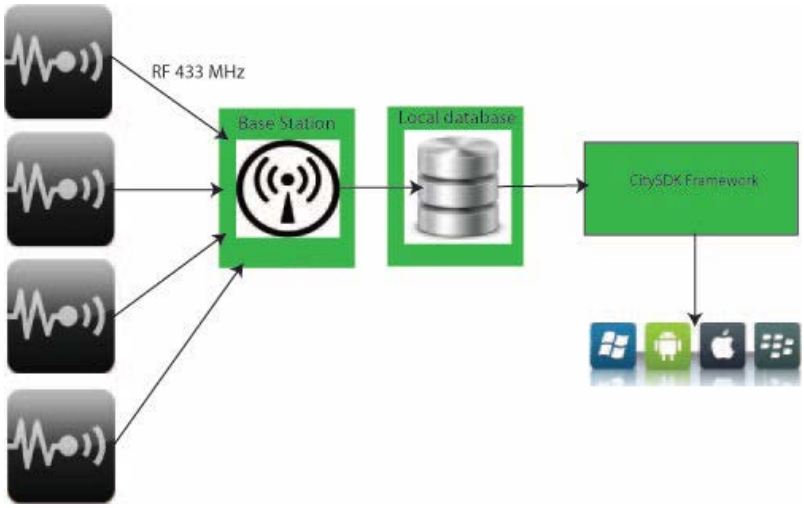

Figure 4.4 – Data flow from the sensors to the mobile applications

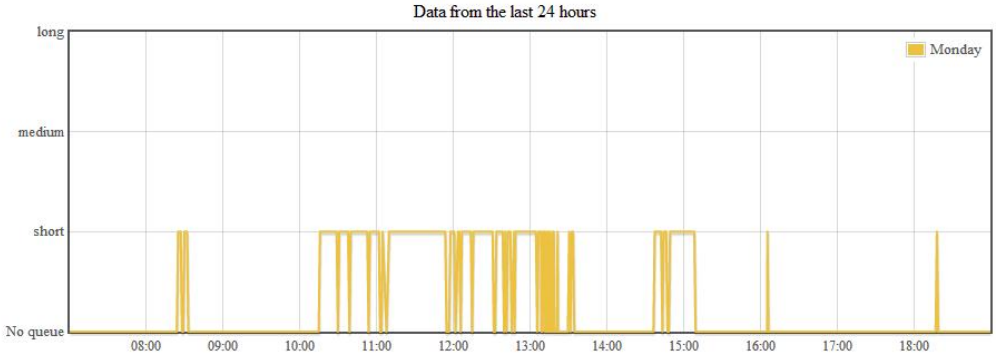

Figure 4.5 – Example of the data collected over a period of 24 hours

To make this data accessible to the Van Gogh museum we've created a visualization (see figure 6), which shows the queue length at the Van Gogh museum. This visualization shows the data of the queue length over time. Also the user can select the different days of the week to see how the different days have influence on the queue waiting time. This is now being used by the museum to get a quantitative inside on when there is queue.

4.1.4. Feedback on the Tourism API

At the moment, the process of updating existing entries in the CitySDK database is not intuitive. When updating a single value of for example an event, the entire event is updated with the post request, removing any other data fields not contained in the post requests. It would be ideal that only the fields that are send via the post requests are updated. Also currently there is no possibility to get a historic overview on the data. This feature could be useful for developers who want to create 'overview over time' applications. This feature could also be very useful for academic purposes for research on changing data patterns or self learning algorithms.

4.2. Engagement and Impact

4.2.1. Engagement activities

- A presentation was given at "hack the government" hackathon,[9] about the possibilities of CitySDK (for 50 decision makers from the Amsterdam region)
- A presentation was given at the University to incorporate CitySDK within educational program (20 lecturers and researches).
- Three lectures were given about CitySDK for upcoming student developers. (150 students)
- We created a movie about the possibilities and plans on dynamic data within the city of Amsterdam to show at the Digital Tourism-event in Helsinki (30-50 developers).

In the process of finding a cultural venue, with a regular waiting line, it was important to keep in mind both the usefulness of the created data for tourists as well as the usefulness for the venue itself. Venues are hesitant to open up their data if they do not see the advantage the data could have for themselves. With the data we collected with our sensor system we created overviews for the Van Gogh Museums, which gives them insight in how the waiting line evolves during the day, or differs between separate days.

4.2.2. Impact

Benefits of Open Data

At the moment, the municipality of Amsterdam is seeing the possibilities of open data and is opening up more and more data via their own open data platform. While this data is in all different formats and not very accessible, it shows the good intentions of the municipality. Also, both the municipality and other cultural venues are seeing, partly because of our pilot

[9] http://www.hackdeoverheid.nl/

at the Van Gogh Museum, the power and opportunities that dynamic data can have. We have opened the eyes of the municipality about the possibilities of such data, which is not just restricted to tourism, but could also have great impact on the citizens of Amsterdam.

Project communication

- Participated in workshop SenCity at UbiComp 2013 regarding smart cities. (25 researchers)
- A presentation was giving for the tourism board of the Amsterdam municipality, showing the possibilities of the CitySDK. (15 decision makers)
- A presentation was given at the open innovation 2.0 – sustainable society and economy, Digital Agenda event in Dublin in conjunction with Irish presidency[10];
- e participated in a session on Smart Cities – paper presentation "Open Innovation 2.0" yearbook 2013 published by the European Commission – chapter on CitySDK[11];
- Attended International Open Data day, in which CitySDK was promoted to 30 developers.

Publications

- Groen, Maarten, Wouter Meys, and Mettina Veenstra. "Creating smart information services for tourists by means of dynamic open data." *Proceedings of the 2013 ACM conference on Pervasive and ubiquitous computing adjunct publication*. ACM, 2013.[12]
- Sargsyan, Gohar: "Open Innovation in smart cities: the rise of digital entrepreneurs" – chapter on CitySDK. Open Innovation 2.0 yearbook 2013 published by the European Commission. ISBN 978-92-79-25864-0.[13]

4.3. Next steps

In the next phase of the project we will focus on the following activities:

- Developer engagement;
- Push apps to Google Play store;
- Dissemination;
- Further field test at van Gogh museum.

With the developer engagement we're planning to incorporate CitySDK more within the educational projects. Students will develop applications and visualisations based on the data

[10] http://ec.europa.eu/digital-agenda/en/conference-sustainable-economy-society
[11] http://ec.europa.eu/digital-agenda/en/conference-sustainable-economy-society
[12] http://dl.acm.org/citation.cfm?id=2499215
[13] http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?doc_id=2118%20Open%20Innovation%20in%20smart%20cities:%20the%20rise%20of%20digital%20entrepreneurs

that is available in the CitySDK. Also, we have contact with developers who have already created an app based on the Helsinki and Lisboa CitySDK, and will create an app for Amsterdam as well.

We will also push an application to Google Play store that is able to show the events within Amsterdam and show a route to that specific event based on the Amsterdam WP5 API.
With dissemination we will continue working on exposing the API to the public. We will do this by exposing and presenting at several events. We will also seek out media attention with several blog posts and news articles.
Van Gogh museum is responding very positive on the possibility to create dynamic open data with the means of sensors. Thus we're expanding this work, based on the work we already did. We will research the possibilities to use different sensors that communicate with the CitySDK API.

5. Replication Pilot: Helsinki

5.1. Implementation activities

5.1.1. Implementation of the Tourism API

The City SDK Tourism API in Helsinki was built during the summer 2013. Now Helsinki's tourism-related data is also available in an internationally compatible form. The strategy for the City SDK Tourism domain in Helsinki has been to first build a partial version of the API in order to then collect feedback from developers to get a better idea about the best formats and functionalities that would allow to make the API as usable as possible. The full version of the City SDK API will take into consideration the feedback and suggestions provided by the Developers. Throughout 2014, more event data will be offered through the City SDK API through the Linked Events project, which aims to unify and enrich event data offering in Helsinki.

The City SDK Tourism API was implemented based on the Linked Events-project's realization at: http://events.hubi.fi/, and the implementation was done by a subcontractor, Mysema.

At the moment, the current offered Tourism API's in Helsinki, based on the event data are the following:

- Linked Events –project's API's: EventsML XML[14], Basic JSON[15]
- City SDK Helsinki API: CitySDK JSON[16]

During the next months the plans are to provide a full version of the CITY SDK Tourism API for Helsinki.

5.1.2. Data sets

Luckily, Helsinki already has a good open data offering related to touristic information. The City SDK Helsinki API uses data from the Visithelsinki.fi[17] and Helmet.fi[18] services. The Tourist and Convention Bureau of Helsinki offers event and sight data through the Visithelsinki-service. These events are linked to their locations (POI's). Latest addition to the data, Helmet, offers data of events in local libraries in Helsinki.

Itineraries data is not currently available in Helsinki but plans exist to make route data available in digital format in the future.

[14] http://events.hubi.fi/eventsml.html
[15] http://events.hubi.fi/rest.html
[16] http://events.hubi.fi/citysdk.html
[17] http://www.visithelsinki.fi/
[18] http://www.helmet.fi/fi-FI

5.1.3. Applications and services

Rather than building up separate applications, the City of Helsinki wants to promote the use of the API to developers so that new applications would be developed. The City has only limited resources and an advantageous way to use these is to provide data and challenges to the developers and Start-ups in the field in order for them to develop services based on the data.

A great example of this is the Spot in Helsinki. It is an android application for tourists in Helsinki developed by a local team consisting of two friends. As a matter of fact, their interest to use the City SDK Tourism API rose through our developer events in Helsinki. Forum Virium Helsinki has been in tight contact with the developers behind the Spot-in-Helsinki application in order to provide information and contacts to test the City SDK Tourism API. Eventually, a Spot-in-Lisbon Beta-application was built over only a weekend, based on the City SDK API in Lisbon.

5.1.4. Feedback on the Tourism API

Interoperability of the Tourism API has received positive comments form the developers in Helsinki. The users have been enthusiastic about the core message of the City SDK project.

Feedback has been collected from developers in Helsinki about the Tourism API and its format. The main topics of the feedback have concerned the POI format and the connection of events and POI's. Showing POI's and events in the same format has seemed to confuse developers, and linking the two has been suggested as an improvement for this (so the event would contain the POI id for instance). There is also concern about the continuity of the future development of the POI format specification in W3C.

For the future development for the City SDK Tourism API, the following has been suggested. When developing this API further, recommendations that it could support Scema.org format exist. Scema.org offers a more standardized ways to show the event data than W3C POI as it is a format concentrating specifically on showing events rather than POI's. It is considered to be more favourable for developers as the address information is easier to use, to show the start and end dates for events and has standardized ways to show price information of the events. Unlike POI format specification in W3C, Schema.org is being further developed and sustained also in the near future.

5.2. Engagement and impact

5.2.1. Engagement activities

As aforementioned, from the beginning, the goal has been to open-up discussion to the developers in order to get feedback from the developed API. Through the Helsinki region

infoshare web portal, which offers Open data from the Helsinki Region, interactive communication have been on-going between the developers and the subcontractor who has built the API's.

Discussion & comments about the CitySDK Tourism API in Helsinki can be found in the forum[19] created for this purpose, mostly in Finnish.

The Tourist and Convention Bureau of Helsinki has been tightly involved in the project. We have also had many SME's participating in our events and feedback discussions in Helsinki.

Helsinki has a developer portal Hel<3Dev[20]. Helsinki<3Developers brings together a wide range of activities through which the City of Helsinki collaborates with developers. The Tourism-related data and API's are also presented in the website and all tourism –related events and news to developers are promoted through the website.

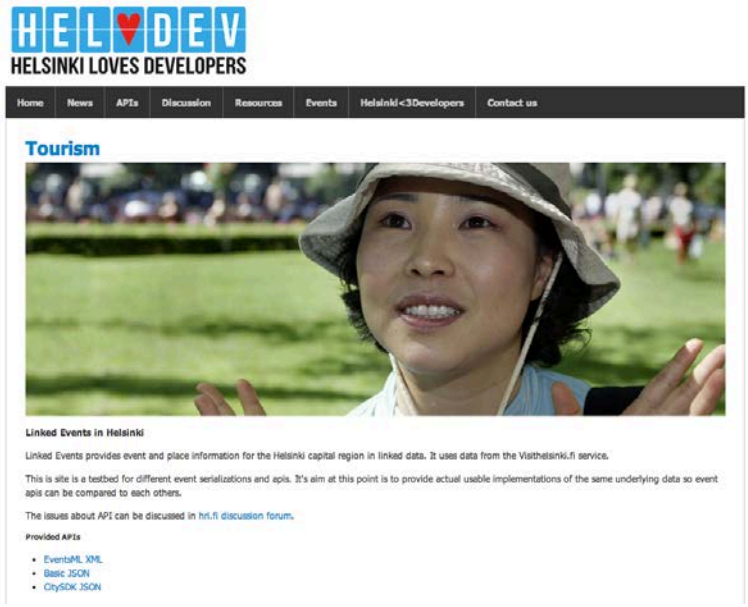

Figure 5.1 – Website of the "Helsinki Loves Developers"

5.2.2. Impact

Benefits of Open Data

As aforementioned, the tourism –data such as events and POI's have been available in Helsinki already before the City SDK project. The Tourism domain has not thus focused on opening data.

Project communication

The City SDK Helsinki's and Forum Virium Helsinki' s Facebook and Twitter accounts have been used to encourage participation into the planning of the API. In addition to social

[19] http://www.hri.fi/fi/keskustelut/tapahtumarajapinta-linked-events-2/
[20] http://dev.hel.fi/

media, Forum Virium Helsinki has used its traditional communications channels (web, newsletter) to inform about Tourism-and City SDK -related news and events.

5.3. Next steps

As aforementioned, the next steps in Helsinki focus on setting up the Lisbon API to Helsinki. The plan is to install the Lisbon software and fetch information from the current Linked Events through a write API. The most feasible way to realize this set up is now being discussed.

After the full set up of the API the goal is to promote its use both in Finland and internationally. We hope to collect feedback from developers on the execution in order to then set up development goals for longer term.

At the same time, as no itineraries exist in Helsinki in digital form, the goal is to first evaluate the execution of itineraries. The city of Helsinki has provided many paper leaflets to tourists about different routes in the city centre, so a lot of material exist and the need for digitalizing these exist.

6. Replication Pilot: Lamia

6.1. Implementation activities

6.1.1. Implementation of the Tourism API

Following the instructions from CitySDK tourism platform installation guide, which describes the requirements and installation procedure for the CitySDK Tourism Platform, we employed a Microsoft Windows Server 2008 R2implemented with Internet Information Services 7 (IIS7), Microsoft .Net 4.5 Framework, and MongoDB (latest 64bit version for Microsoft Windows).

The next step was to convert our datasets according to the W3C POI standard as described on CitySDK Deliverable D5.1. In more specific, we had to fetch our datasets from a MySQL database, which was already created and available through the official site of the Municipality of Lamia[21] with the help of Drupal content management system (CMS). This was achieved by creating PHP scripts (a custom Drupal Module) as it is described graphically in Figure 6.1.

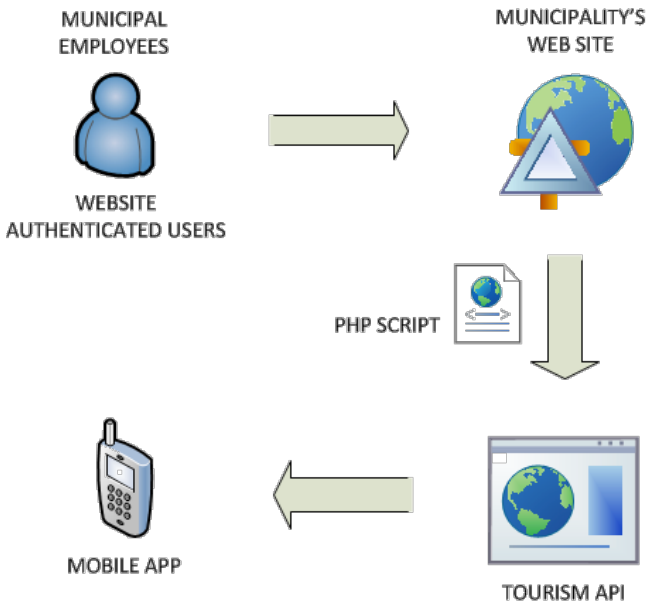

Figure 6.1 – Data flow through the PHP scripts and Tourism API

Our final step was to set up the appropriate methods to insert, update, retrieve and delete our data elements (categories, POIs, Events, Itineraries) based on the RESTful API concept as it is described in CitySDK Data Administration API (PUT, POST, GET and DELETE HTTP verbs). Based on the same Drupal Module, that we created to convert our datasets to W3C

[21] http://www.lamia.gr

POI standard, we implemented several PHP functions, compliant to Drupal CMS requirements, making it possible an on the fly synchronization of our datasets.

As the result of the above we manage to expose our open data sets through CitySDK Tourism API server implementation using the following endpoint: http://tourism.citysdk.lamia-city.gr

Specifically adjustments had to be taken as far as it concerns the Greek characters that had to be convert from html entities, because of the json decode method, and the fields containing date format values that had to be transformed to iCalendar standard.

In order for developers to understand the API we created a web widget visualizing the datasets that we expose through it as you can see in the following link: http://www.lamia.gr/en/tracker-poi-map.

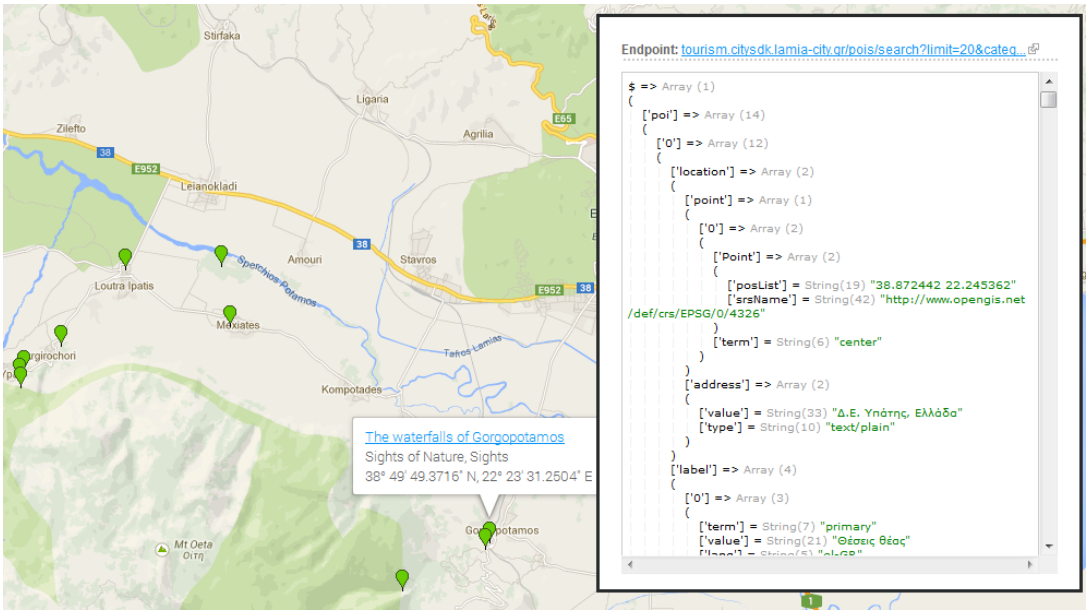

Figure 6.2 -

6.1.2. Data sets

Through our Tourism API implementation the Lamia Pilot publishes the categories of datasets presented in Table 6.1.

Table 6.1 - Data sets available in Lamia

Type of data	Category	Sub-Category
POIs	Settlements of the Municipality	
	Public Services	
	Accommodation	Rent, Hotels
	Activities	Healing Springs, Paths

Type of data	Category	Sub-Category
	Sights	Forest Village, Sights of Nature, History - Archaeological Sites
	Culture	Theatres, Museums, Libraries, Education, Cultural Centers
	History	Places, Castles, Monuments
	Archaeology	Monuments, Places, Findings
	Folklore – Folkways	Traditional Buildings - Architecture
	Religious Places	Churches Monasteries
	Places for sport & pleasure	5x5, Contact sports, Multipurpose room, Volleyball, Walking routes, Swimming, Basketball, Playgrounds, Cycling, Football, Skating, Track, Tennis, Archery, Handball
	Pharmacies	
	HotSpot places	
Events	Sports, Carnival, Award, Competitions, Various, Visual Art, Education, Anniversaries, Business/Trade, Theatre, Cinema, Social, Street Market, Opera, Children & Family, Feast, Easter, Environment, Culture, Concerts, Arts, Health, Food & Drink, Festival, Photography, Dancing, Christmas	
Itineraries	Religious routes	
	Thermal spring routes	
	Historic – Cultural routes	
	Eco routes	
	Tourism routes	

In our future plans is to insert into the API database open datasets of catering like taverns, cafes, restaurants, etc.

6.1.3. Applications and services

An application, integrating the CitySDK Tourism API, was developed with many functionalities. The main goal of the application is to test API and to give developers a

challenge to develop their own applications. Still, it is fully functional taking advantage of API's capabilities.

User interface's language depends on device's settings. Currently supports Greek and English. Endpoints consumed by the API are Lamia's, Lisbon's, Amsterdam's and Rome's. More endpoints will be added.

Main functionalities:

- Consumes different endpoints
- Greek and English interface language
- Many search criteria e.g. keywords, categories, geolocation, date, QR-code etc.
- Shows image and description of the selected POI
- Routing to the selected POI or event
- Map clustering
- Navigating the map display of nearby points
- Shows all geo-location information on the map
- Text and Text to speech presentation
- AR (Augmented reality) capability

Below you can see some screenshots from the application in Figures 6.3 and Figures 6.4.

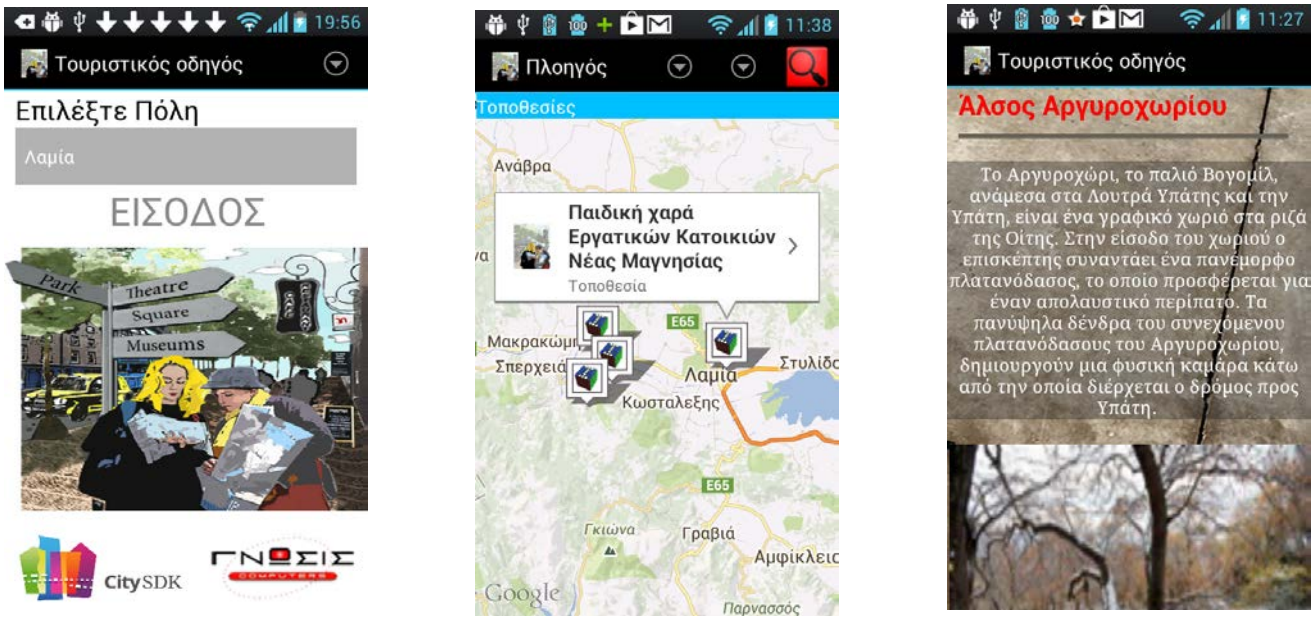

Figure 6.3 - Screenshots of the demonstration application

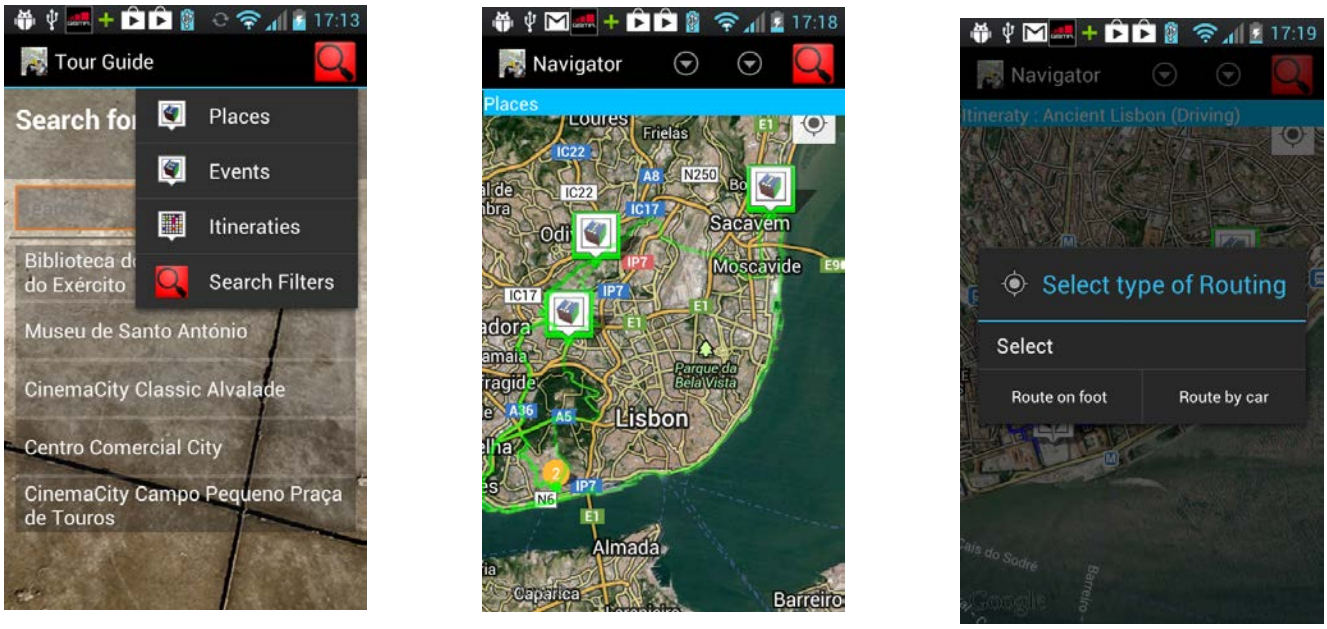

Figure 6.4 - Screenshots of the demonstration application

Applications can be download from below links (Over 500 downloads):

- Google Play: https://play.google.com/store/apps/details?id=com.smarts.tourguide&hl=en
- Windows Phone: http://www.windowsphone.com/en-us/store/app/tourguide/351b0be3-c169-4fc5-9e04-7c5763d36e8b

In addition to above application another one was developed to help the organization of a national running race.During Hercules Marathon (that was the name of the race) the application helpedthe organizing committee, runners, volunteers and audience supplying combined tourism and mobility data. Users could be informed about POIs near the location of the race and learn about events that took place the same period with the race.

6.1.4. Feedback on the Tourism API

Some of the improvements that could be made to tourism API are:

1. One of them could help a tourist that visited a POI or attended an event or followed an itinerary could submit his/her feedback about info for :
    a. a POI e.g. ease of access,
    b. an event e.g. how crowded it was
    c. an itinerary e.g. how many POIs the itinerary covers.

2. Personalization features like
    a. Insert of photos of a POI with more artist approach
    b. Participate on conquests with gifts
3. Gamification techniques of the style “Find the treasure in the X POI”
4. Add of advertisements for a more commercial version of the API

The above additions could improve interaction between API consumers and data providers.

6.2. Engagement and impact

6.2.1. Engagement activities

The Activities we carried out to engage developer communities and end-users into open innovation processes, are presented in the following table:

Table 6.2 - Engagement activitieis carried out in Lamia

Actual Dates	Location	Event	Main target groups – Participants
05/09/2012	Lamia’s 5th High School	Annual meeting of High School’s teachers (with specialty in Computer Science)	Academic audience (70). Teachers and Professors with specialty in Computer Science to transfer knowledge to young students
12/09/2012	Technological Education Institution of Lamia	Meeting for the project’s presentation and dissemination	Software engineers (10) Engineer’s association advisory board.
19/09/2012	University of Central Greece	1st Open Data Workshop for Academic audience.	Academic audience (70). Teachers and Professors with specialty in Computer Science to transfer knowledge to young students
24/10/2012	Technological Education Institution of Lamia	Meeting for the project’s presentation and dissemination	Software engineers (10) Engineer’s association advisory board.
24/04/2013	University of Central Greece	Meeting for the project’s presentation and dissemination	Academic audience (70). Teachers and Professors with specialty in Computer Science to transfer knowledge to young students
18–26/05/2013	PanHellenic Exhibition of Greece	Special Hall for the promotion of CitySDK activities	Wide Public (35.000 visitors)
03–06/06/2013	City’s events centre	Pan-European week of environment	Ecologists, environmental groups, (Over 800 participants)

Our efforts for engagement were mostly to developers of our city. These are High School teachers with specialty in computer science and academic teachers and students from the local University of Central Greece and the Technological Education institution of Lamia.
Moreover a PanHellenic Exhibition is held every year in the city of Lamia. This exhibition usually has wide public participation, more than 35.000 visitors. This year there was a special kiosk for the promotion of CitySDK project.
Finally, few days ago a conference of the Hellenic Society for Computational Biology and Bioinformatics was organized in University of Central Greece, at the city of Lamia. We had a general presentation for CitySDK project at an academic audience, but at the same time we tried to engage students into open innovation processes.
Some special events took place in the city of Lamia for the same scope, for engagement of developers and end-users. These were 2 athletic events had wide public participation, as we can see from the following table. During these events, two applications were developed by a team of developers, supported by GNOSIS, to help the organizing committee, runners, volunteers and audience that combined tourism and mobility data.

Table 6.3 - Special events where CitySDK was present in Lamia

Actual Dates	Location	Event	Main target groups – Participants
11/05/2013	1st Lamia Night Run	CitySDK support for athletic event	Wide Public (Over 1200 participants. Over 25000 visitors of special web site)
22/09/2013	Technological Education Institution of Lamia	CitySDK support for athletic event	Wide Public (Over 1200 participants. Over 25000 visitors of special web site)

Stakeholders

Table 6.4 - Activities performed to engage stakeholders

Actual Dates	Location	Event	Main target groups – Participants
10/10/2012	Mercantile Chamber of Fthiotida	Meeting for the project's presentation and dissemination	Commercial public (40). Representatives of tourism businesses and tour operators
11/03/2013	Municipality of Lamia's Boardroom	Meeting for the project's presentation and dissemination	Commercial public (40). Representatives of tourism businesses and tour operators

Other cities

Table 6.5 - Activities performed to engage other cities

Actual Dates	Location	Event	Main target groups – Participants

Actual Dates	Location	Event	Main target groups – Participants
15/11/2012	Hall meeting of regional association of municipalities in Sterea Hellas	Meeting of regional association of Municipalities in Central Greece. Short presentation	Mayors of Municipalities in Region of Sterea Hellas (15)
12-13/03/2013	Stutrgart Frauhofer institute	TIDE project Workshop	Participants from Wien, Madrid, Reading, Kalw, etc.

6.2.2. Impact

Benefits of Open Data

The impacts from the process of opening data in city of Lamia, that were already achieved, are:

- For Municipality:
  - Improvement of local governance through regeneration and more efficient and sustainable uses of the facilities and resources located in the city
  - Enhance communication and interactions between city's administrations, developers, businesses and citizens
  - Develop new public assets, including a city information infrastructure
  - Provide more effective links between economic, social and environmental planning within the city
  - Captured and shared experience and expertise in these areas from across the EU and worldwide
- For Developers:
  - Datasets that have never been collected and exposed, now have been done
  - Incentive for creating digital content and online enhancing services
  - Creation of an open digital framework for cooperation with city
- For Users:
  - Multichannel (web, mobile devices) access to Lamia's digital services through a single point
  - New more attractive and useful online services and apps
  - Improved quality of information for citizens
  - Ease of access to use of critical information and services
  - Provision of complex sets of information in a friendly way

Project communication

Table 6.6 - Activities performed to communicate the project CitySDK

Actual Dates	Location	Event	Main target groups – Participants
15/02/2013	Lamia's Conference Centre	Official launch of Lamia's new webpage	Representatives of press, media, research institutions, commercial organizations, scientific bodies, academic institutions, Town Council and wide public (120)
15/04/2013	Lamia's Conference Centre	1st Wide event for the project's presentation and result's dissemination as they have become available.	Representatives of press, media, research institutions, commercial organizations, scientific bodies, academic institutions, Town Council and wide public (120)

6.3. Next steps

The next steps for the near future (not only to the end of the project), are:

- For Municipalities :
  - Collect and expose new datasets in a wider region
  - Inter-municipal approach to cover more Municipalities of the region
  - Analysis of a new business model for co-exploitation of the information with SMEs
- For Developers :
  - New datasets to be collected and exposed
  - Central rewarding mechanism
  - Engagement activities
- For Users:
  - Gamification techniques
  - Crowd sourcing approach
  - Rewarding system
  - Selective redesign for ease of access to use of critical information and services
  - More mobile's OS platforms to be supported

7. Replication Pilot: Rome

7.1. Implementation activities

7.1.1. Implementation of the Tourism API

To keep the CitySDK application constantly synchronized with up-to-date data we used Nodeshot, an Open source application developed in house by Caspur/Cineca, which allows layers of geo-referenced data to be pulled from and sent to other external web services.
Two importers for Nodeshot have been written to convert and keep up to date the hotspot data of 13 public administrations - as of today.

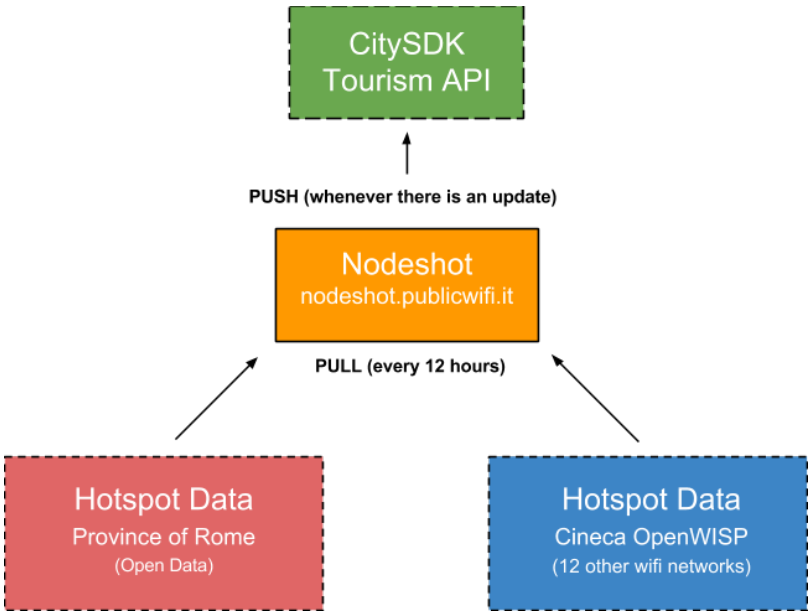

Figure 7.1 – Simplified architecture of the API implementation in Rome

The first importer is specific to the XML format used by the Province of Rome, while the second importer has been written for GeoRSS, which is the standard format used by OpenWISP. Because many cities in Italy use OpenWISP, once the importer has been refined and tested, it made it possible to import data from the cities that use OpenWISP fairly quickly.

7.1.2. Data sets

Hotspot data from 13 cities are already available to developers and citizens, as Open data, to be exploited also through the CitySDK Tourism API pilot application. The single datasets range through the 3 levels of administration representing the local government in Italy (Region, Province, and Municipality) and cover a good part of the territory:

- Provincia di Roma
- Regione Friuli Venezia Giulia
- Provincia di Gorizia

- Provincia di Pistoia
- Provincia di Frosinone
- Provincia di Grosseto
- Provincia di Brescia
- Comune di Genova
- Comune di Lamezia Terme
- Comune di Salerno
- Comune di Rosignano Marittimo
- Comune di Torino
- Regione Piemonte

More datasets from other cities are going to be added.

7.1.3. Feedback on the Tourism API

Rome set up its own WP5 CitySDK toolkit driven API server; the process was fairly smooth, considering that our developers' main focus is not MS technology. Stress tests showed the API toolkit to be:

- A robust server application supporting 2000+ http requests in less than a minute
- As of today, 2000+ hotspots are handled with no sign of stress

Under the developers' standpoint, we have suggestions regarding the depth of the documentation, which would improve the speed of the setup process for those not familiar with MS technology, specifically:

- API embedded documentation
- Specific documentation on how to debug/monitor the application

7.2. Engagement and impact

7.2.1. Engagement activities

Developers have been involved in both formal events and informal sessions with developer communities, with content tailored to the interest of the audience and aimed at getting a specific interest by:

- Showing CitySDK technical insights and development towards open innovation processes;
- Focusing on the fact that CitySDK framework application development will eventually facilitate employment by PA;
- Suggesting that knowing CitySDK development will facilitate job mobility within EU;

- Informal sessions have been held with the aim to involve the ninux.org community into CitySDK.

Stakeholders

The development has been influenced by the datasets available when the project started, as by those potentially available during the project lifetime – and beyond. The efforts made by creating existing data and acquiring new ones came, in turn, from requests made by end-users.

Other cities

Following the recent October event, the "Free ItaliaWiFi federation conference meeting", the 23+ Italian LPAs have been shown the potential of CitySDK with the double aim to get:

- Access to hotspots data to be brought into CitySDK;
- Participating administrations to explore the advantages of CitySDK driven application development

Outcomes (as of today):

- Formal access to the hotspot data of 14 cities/administrations
- 13 datasets already in CitySDK, more to be added
- Dissemination of CitySDK to the 3 levels of LPAs (Region, Province, Municipality) on the whole Italian territory

7.2.2. Impact

Benefits of Open Data

Open data introduction somehow represents:

- A push for institutional investments towards the creation of an additional layer of IT-driven interaction with citizens
- Getting the local community feeling somehow progressively closer to the Institution
- Enhanced cooperation among internal departments of Provincia di Roma in projects where sharing data is required
- Stronger cooperation strategies within the "Rome Team"
- New cooperation strategies with the different levels of administration forming Italian LPAs infrastructure

Project communication

We noticed interest shown, in CitySDK and Smart Cities related informative web pages published by Provincia di Roma, Caspur/Cineca and Lynx, from citizens, developers and PA decision makers.

The Rome team believes that it will be particularly effective, to reach all target groups, for us to schedule communication events around M25 when our replication pilot applications will be nearly ready for launch, to fully express the added value given by the CitySdk framework

7.3. Next steps

Getting WiFi hotspot data from more cities / administration will be an ongoing process involving the creation of new institutional channels aimed to expand CitySDK as a whole. Currently, we are waiting for the data from 10 more WiFi networks in the Italian territory to be available:

- Comune di Venezia;
- Provincia di Prato;
- Regione Sardegna;
- Provincia di Cosenza;
- Provincia di Firenze;
- Fondazione Gran Paradiso;
- Comune di Marsala;
- Comune di Pisa;
- Comune di Settimo Milanese;
- Provincia di Siena.

Such WiFi networks all belong, together with the ones already imported into CitySDK, to the Free ItaliaWiFi federation[22], a project seeing Provincia di Roma as one of the promoters which allows citizens to use any of the access points in any of the federated cities using the same credentials. About 20 more cities expressed their intention of joining as soon as they will have the infrastructure fully working.

CitySDK has been an important factor to speed up the process of refactoring of the following tourism related dataset already published in the CKAN portal of Provincia di Roma; they are currently being improved both in the depth/quality of content and in the degree of linking among data sets, and will be soon imported, when ready, into the CitySDK Tourism domain:

- Archaeological sites (POI);
- Public libraries (POI);
- Museums (POI);
- Events of touristic interest.

[22] http://fiwen.provincia.roma.it/whats-free-italiawifi

8. Conclusions and Future Work

CitySDK Tourism API was continually improved to better address the requirements defined in D5.1, as considering the feedback provided by the Replication Pilots and developers. The API is now implemented in the Lead Pilot, as well as in all the four Replication Pilots of the Tourism domain, being available at the respective endpoints. Every Pilot has open data sets available to be accessed and used by Developers to create applications for services oriented for Tourism or even other domains relevant to the Cities.

To ensure this process would reach the best results, the team from the Lead Pilot provided active support both to the teams from the Replication Pilots as to the Developers that addressed any help request. Demonstration applications and a reference server were also developed and made available to reinforce the support effort, helping developers creating new applications and cities implementing the servers to make open data available.

The CitySDK Tourism API also enables applications to access the open data of different cities to provide the same services and experiences to tourists travelling across Europe. This feature ensures a large ecosystem for the Developers to test and launch their applications, representing a potential market with millions of users. Moreover, the ecosystem has an unlimited potential of growth, as more cities start using the CitySDK toolkit to open their data.

Therefore, along with the continuously improvement of the current APIs, the future work for the project is related with the expansion of the network of cities implementing CitySDK servers to provide open data. The development of new APIs or the adaption of the existent APIs to different domains can also be explored in future work.

9. ANNEX I

9.1. SDK Components Package

Component	Type	Description	URL
Lisbon			
CitySDK Tourism API	Endpoint/API	CitySDK Amsterdam Tourism API endpoint	http://tourism.citysdk.cm-lisboa.pt/resources
Client Library - Java	Source Code	Client library for helping the development process in Java.	https://github.com/CitySDK/tourism_library_java
Client Library - Java	Documentation	Documentation of the client library for helping the development process in Java.	http://citysdk.ist.utl.pt/jdoc/index.html http://citysdk.ist.utl.pt/libraries.html
Client Library - JavaScript	Source Code	Client library for helping the development process in JavaScript.	https://github.com/CitySDK/tourism_library_js
Client Library - JavaScript	Documentation	Documentation of the client library for helping the development process in JavaScript.	http://citysdk.ist.utl.pt/jsdoc/index.html http://citysdk.ist.utl.pt/libraries.html
Client Library – PHP	Source Code	Client library for helping the development process in PHP.	https://github.com/CitySDK/tourism_library_php
Client Library - PHP	Documentation	Documentation of the client library for helping the development process in PHP.	http://citysdk.ist.utl.pt/libraries.html
Client Library – Objective-C	Source Code	Client library for helping the development process in Objective-C.	https://github.com/CitySDK/tourism_library_objc
Client Library – Objective-C	Documentation	Documentation of the client library for helping the development process in Objective-C.	http://citysdk.ist.utl.pt/libraries.html
Mobile Guide	Application	Android application that has been used for demonstration. It has a map and list view, it is possible to search for POI, events and routes with filter options, for example searching for name or tag.	http://citysdk.ist.utl.pt/apk/Mobile%20Guide.apk

Component	Type	Description	URL
Web Widgets - Events	Application / Source Code	Web application that provides a calendar tools to search for events in a time interval. This application has the option to search in 2 endpoints: Amsterdam and Lisbon.	http://citysdk.ist.utl.pt/applications.html / http://citysdk.ist.utl.pt/js/calendar/calendar-loader.js
Web Widgets - Map	Application / Source Code	Web application that provides draw tools to search for POIs, events and routes. This application has the option to search in 4 endpoints: Amsterdam, Lamia, Lisbon and Rome and the results are shown in the map.	http://citysdk.ist.utl.pt/applications.html / http://citysdk.ist.utl.pt/js/map/map-loader.js
Layar layer	Application Layer	Layer to provide the API's information to Layer application. This applications runs on Android and iOS, bringing augmented reality.	https://www.layar.com/layers/csdktourism
Server	Server / Documentation	This reference implementation allows anyone to implement his own server and provide his own data.	http://citysdk.ist.utl.pt/apidoc/CitySDK%203Out13%20API.zip / http://citysdk.ist.utl.pt/server.html / http://citysdk.ist.utl.pt/apidoc/CitySDK%20WP5%20Installation%20Guide.pdf / http://citysdk.ist.utl.pt/apidoc/CitySDK%20Data%20Administration%20API.pdf
Amsterdam			
CitySDK Tourism API	Endpoint/API	CitySDK Tourism API endpoint in Amsterdam	http://citysdk.dmci.hva.nl/CitySDK/resources
CitySDK webviewer	Web application	Map overview of the data currently available in the Amsterdam Tourism CitySDK	http://citysdk.dmci.hva,nl/map
Hardware schematic	Framework	Hardware schematics of the sensor system, as well as 3D models of the sensor casings	http://citysdk.dmci.hva.nl/downloads/Hardware_and_sensor_building_blocks_CitySDKWP5.rar
Sensor software	Software	Software used to program the sensors used in the fieldtests regarding dynamic open data	http://citysdk.dmci.hva.nl/downloads/Hardware_and_sensor_building_blocks_CitySDKWP5.rar
Routing application	App	Example application of the routing application using data from the CitySDK	http://citysdk.dmci.hva.nl/downloads/Amsterdam_CitySDK_app.rar
Helsinki			

Component	Type	Description	URL
City SDK Helsinki endpoint	Endpoint/API	Helsinki implementation of the CitySDK Tourism API including event and POI data in Helsinki.	http://events.hubi.fi/citysdk/v1
Lamia			
CitySDK Tourism API	Endpoint/API	CitySDK Tourism API endpoint in Lamia	http://tourism.citysdk.lamia-city.gr/resources
LamiaWebServices_Tourism.pdf	Document	This document describes the REST web service interface of the tourism information provided by city of Lamia. The interface is intended for an integration with another software system. It is not an end-user interface used by human users.	
SRS_Tourism.pdf	Document	The document defines the Software Requirements Specification (SRS) for the Tourism component of the SmartCity SDK	
WebServices_Tourism_1 2.pdf	Document	This document describes the Technical Specification for the Tourism Service Provider – Client Tourism Reporting Web Service of SmartCitySDK project for the city of Lamia	
SDD_Tourism_1.1.pdf	Document	This document describes the Functional Software Design Description for the Tourism Service of SmartCitySDK project for the city of Lamia	
Mobile TourGuide	App	Mobile TourGuide for Lamia city and others European cities. Mobile TourGuide constitutes an application for cities travel guide and navigation, supported by Gnosis Computers. Places, Events, as well as Itineraries which are dynamically updated, build a rich information knowledge base which becomes available for users in 2D as well as in 3D forms.	https://play.google.com/store/apps/details?id=com.smarts.tourguide&hl=en
Mobile TourGuide	App	-//-	http://www.windowsphone.com/en-us/store/app/tourguide/351b0be3-c169-4fc5-9e04-7c5763d36e8b
Rome			
CitySDK Tourism API	Endpoint/API	CitySDK Tourism API endpoint in Rome	http://citysdk.inroma.roma.it/CitySDK/pois?limit=200

Component	Type	Description	URL
Demonstration application	App	Demonstration application for data visualization	http://citysdk.inroma.roma.it/wp5-pilot/
Nodeshot	App	Extesible Django web application for management of community-led geo-referenced data	https://github.com/nemesisdesign/nodeshot/ https://github.com/nemesisdesign/nodeshot/blob/master/nodeshot/interoperability/synchronizers/CitySDKMixin.py