



SEVENTH FRAMEWORK PROGRAMME

Networked Media

Specific Targeted Research Project

SMART

(FP7-287583)

Search engine for Multimedia environment generated content

D5.4 SMART Mash-up Libraries and Visualization Techniques

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Summary of the document

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Abstract:	A prototype implementation of the SMART mash-up libraries (and other means for Web2.0 / Web3.0 compatible mechanisms for query visualization). The deliverable reflects the work performed in T5.5 and is the first version (D.5.4.1).
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1 **Executive Summary**

Among the objectives of WP5 is to devise and implement reusable mash-up libraries for visualizing results of the multimedia search queries over sensor data. The deliverable reports on the work performed so far (Month 21 of the project) by partners under task T5.5 (Reusable Mash-ups for Query Visualization), where the focus is on the visualization/presentation of results derived from the SMART multimedia search engine. To this end, libraries of reusable mash-ups combining services and semantics from the underlying A/V processing algorithms, sensors and social networks are developed and structured in appropriate libraries. The availability of such mash-ups aims at facilitating embedding SMART queries and search results into applications (e.g., through mash-ups for displaying relevant images, mash-ups for depicting crowd analysis events, mash-ups for visualizing images taken from specific locations, mash-ups for highlighting the importance of events in social media).

1.1 **Scope**

The deliverable reports on a task (T5.5) that is still on-going at the time of writing (Month 21-22). Although the set of guidelines used in selecting the technological framework of the visualization components is more or less final, there has been little experience of how the results of a query in Environment Generated Content and Social network content, should be combined and optimally visualised to help the human user identify a phenomenon of interest (in the general case), a feature or a behaviour (in the case of live news), an event of significant operational importance (in the case of security), etc. It is thus important to keep in mind that experience between this initial version (Month 21) will drive the further development of widgets and mash-ups, leading to a more mature visual toolkit to be presented in the final version of this deliverable (Month 30).

1.2 **Summary**

This is the first version of the deliverable, thus reports mainly the progress achieved with regard to assessing needs of envisaged applications, selecting the technology that should address these needs and the components (widgets) that should be part of the mash-up library. For completing one or more stand-alone working demos, the Liferay Portal has been selected and the mash-ups will be developed as portlets. The mash-ups will be developed using jChartFX and JQueryUI, open source Javascript libraries very popular for data visualization, while the map mash-ups will use the 3rd version of Google Maps Javascript API.

1.3 **Structure**

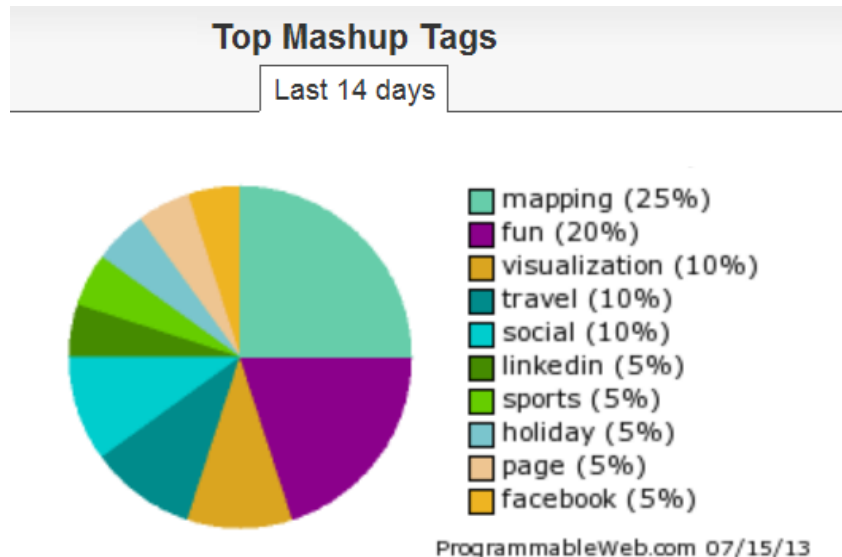
In the following section (Section 2) we review the visualization needs that will be served by the mash-up library. In Section 3 we review Technologies and Platforms involved in the process of producing highly interactive, custom visualization tools, widgets and mash-ups. Next in Section 4, we identify a pair of use cases (Security and Live News) which will prove the versatility and flexibility of the library components, to be evaluated by highly skilled technology partners (PRISA – Live News, S3Log - Security). In Section 5, we identify the interface between the visualization layer and the search layer. Finally, in Section 6, we present the versatile web-based platform (Liferay) we used to develop a set of ten (10) widgets for our use cases which form part of the mash-up library.

2 Rationale and Requirements

2.1 Introduction

The term “mash-up” is used by the music industry referring to the combination and/or remixing of existing musical elements into a new form, according to many experts, but now has been adopted by information technologists to refer to new Web applications or sites created through the combination and re-use of data and/or functionality from two or more disparate and usually third-party Web sources. Sources for mash-ups include: content extracted with Application Programming Interfaces (APIs) from existing Web services; data streams from blogs, wikis, and other social networking and news sites delivered via RSS feeds; and Web pages “screen scraped” to harvest desired information [Absher2007].

Mash-ups have recently exploded on the web, for two main reasons. First, many of the major internet companies, such as Yahoo! (www.yahoo.com), Google (www.google.com), and Amazon (www.amazon.com), have opened up their data to be used with other data sources without resort to a lengthy licensing negotiation process. The other reason for this rapid growth is the advent of new tools that make creating mash-ups easy for anyone, regardless of their technical know-how.



2.2 The SMART Mash-up Libraries

The SMART users' base consists of both the end-users (e.g. PRISA, Santander), as well as the SME and individual developers' community (represented in the consortium by TELESTO). In both cases, there is an obvious need to visualize the results of the SMART search engine to the end-user. The mash-up libraries intend to provide the end-user of the SMART system with reusable mash-ups mixing services and semantics from the underlying A/V processing algorithms, sensors and social networks which provide visualization/presentation of results derived from the SMART multimedia search engine.

The purpose of this work is to provide generic visualization components that may be easily combined to offer a custom-built UI (e.g. Dashboard) to give the end-user the ability to overview his query results in a uniform manner remotely through the web from a browser.

The main requirements that derive from the description above as well as the modern needs of today's Internet users delineate a portal/platform containing the reusable mash-up libraries and providing:

- User friendly, easy to use environment.
- Multiple/User-selected result visualization from different sources in the same dashboard.

- Remote access through the web.
- Multi-platform support (e.g. PCs, Tablets, Smart phones)

Thus the product of this deliverable will be a web portal providing the use of SMART mash-up libraries for visualizing results of the multimedia search queries and prioritizing the above user requirements.

3 Technologies and Platforms

3.1 Supported platforms

In the following we use the term “platform” to describe the combination of hardware and software used to run software applications. SMART was from the very beginning thought to address the needs of emerging popular computing platforms, i.e. smartphones and tablets. The consortium decided to employ Web 2.0 development techniques for the portal back-end and HTML 5 for the front-end, technologies that promise ease of development, attractive design, user friendliness and cross-platform portability. Both of the technologies were selected for providing an easy, user friendly interface while making the software accessible through the web on every major platform. Furthermore, liquid (or responsive) design, ensures that the resulting visual output is consistent across platforms and the differences in implementation details (different viewing resolutions and ratios) are easily addressed.

3.2 Web 2.0

The second generation of the World Wide Web available since more or less 2007, is focused on the ability for people to collaborate and share information online. Web 2.0 is mainly referring to the transition from static HTML Web pages to a more dynamic Web that is more organized allowing users to do more than just retrieve information and is based on serving Web applications to them. Building on what was already possible in the conventional Web (or “1.0”), such newer generation websites provided the user with richer user-interface, software and storage facilities, all through their browser. This has been called “network as platform” computing [O’Reilly2006]. Major outcomes of Web 2.0 include social networking sites, user created web sites, self-publishing platforms, tagging, and social bookmarking.

The major innovations for the web originate primarily from newer client-side technologies which allow users to continue to interact with the page, even making asynchronous data requests by separating them from the data coming back to the page thus parallelizing the user interaction on the page. This was made possible by adopting web development techniques such as Ajax (Asynchronous JavaScript and XML) that make use of JavaScript (or more specifically JavaScript’s JQuery library) as a scripting language for client-side programming or frameworks and languages such as XML (Extensive Markup Language) or JSON (JavaScript Object Notation) for the communication between applications through the web.

3.3 HTML 5

HTML 5 is the latest revision of the HyperText Markup Language (HTML) for structuring and presenting content for the World Wide Web and a core technology of the Internet. It aims to improve the language with support for the latest multimedia, while maintaining readability of the code. It is also an attempt to define a single markup language that can be written in either HTML or XHTML syntax. Detailed processing models to encourage more interoperable implementations are included; it extends, improves and rationalizes the markup available for documents while introducing markup and application programming interfaces (Application Programming Interfaces - APIs) for complex web applications as well.

4 Mash-ups in SMART Use Cases

4.1 Introduction

In this section we introduce the use of some of the mash-up components specifically designed for the security and live news use case. For each use case, we identify criteria, guidelines and specification that have driven the design and development of the mash-up components. Because each use case proposes a vertical use for the SMART platform, it is necessary to design ad-hoc components, described in Section 7, to create concrete and complex scenarios. Apart from the description of the requirements for following two use cases in this deliverable, the needs of the use cases documented in the deliverable 2.2 – “SMART Use Cases Specifications” [SMART-D2.2] have been analyzed and taken into consideration as well.

4.2 Security Use Case

In the case of security applications, because of the specific nature of the domain, there are expectations for the human-machine interaction, different from those of other applications. So, while it is appropriate to consider ergonomics and usability, one has to redefine the two concepts, adapting them to the security domain.

When proceeding to the design of the security use case, the following principles for human-machine interaction have been adopted, to specify a roadmap for the development of mash-up components and applications:

- **Human Machine Interface must be simple, intuitive and efficient:** efficient interfaces have clearly visible components and behave so as not to confuse users (e.g. users should always find an easy way to recover from an error situation). Visual components should be arranged for operators in such a way that they can easily understand options and facilities provided by the application: similar tools should be always grouped and placed in the same area of the screen;
- **Mash-up components hide internal mechanisms:** such components should hide their internal mechanisms. Components should work as a ‘black box’: they clearly show only the relevant information or prioritize the critical information, e.g. to better identify possible alarms;
- **Data must be accessible:** All of the information needed to identify an alarm situation must be recorded and easily accessible. If there are correlations between various types of information, such correlations must be graphically displayed to allow the operator to identify the risk factors and react quickly, taking the appropriate decisions;
- **Use of colours:** the number of colours should be limited, preferring high-contrast colours and eliminating those not easily displayable. The use of colours should be consistent (similar actions or states correspond to similar colours). The colour variations must represent only alarms or those changes of state that could be relevant for the operator;
- **Human Machine interface must be intuitive:** in the event of an alarm, the application must respond quickly, showing on the display all the information necessary to identify the nature of the alarm. All of the information must be positioned according to the following criteria: the central area of the screen must be occupied by the map on which all the sensors that have generated the alarm are clearly identified (for each sensor, the nature of the alarm must be clearly and immediately identified); Most often the left side of the screen is reserved for a shortcut to tools and facilities, while the right side of the screen is reserved for the event logs.

In the following, we list the example mash-ups used for the security applications are:

Explosion Detection: this mash-up displays on a map all the events that could identify an explosion in the area. Such events are:

- Sudden variation of the direction of the crowd;
- Sudden variation of the temperature (only for indoor sensors);

- Sudden variation of luminosity (i.e. flash of light);
- Audio sensors data.

To better identify the nature of the phenomenon (a sudden variation does not always constitute a security alert), this mash-up displays information which combines data coming from sensors with data coming from social data feed (the visualized data have been already processed by the reasoning layer).

Crowd Panic Detection: Similarly to the explosion detection, this mash-up displays on a map all the events that could identify crowd panic:

- Crowd noise that grows over a threshold;
- Sudden variation in the direction of the crowd;
- Crowd moving away from a location (sudden change in crowd density);

As well as for the previous case, as the events do not necessarily indicate panic situations, the component integrates the data with the information from the social network data feed.

Tracking Hooligans: This mash-up addresses two issues:

- Using social network data to “follow” a phenomenon on the map (e.g. hooligans)
- Tracking a phenomenon using social data

To do this, this mash-up uses specific keywords to sample data coming from the social network feed and shows for a specific area a visual representation of how the phenomenon, represented by the selected keyword, moves in time. An example is displayed in the following picture:



4.3 Live News Use Case

We have considered an innovative, live news application, which monitors social trends along with specific events and the conditions of the environment (e.g. dominant colors indicate in-fashion raincoats on rainy days). In this specific use case scenario, events are combined with the frequency of colors of people's clothes. The envisaged requirements for the visual components are:

- A map with geo-referenced events.
- A scenario-specific chart of the evolution of colors detected within a long period of time, months.
- Feeds of the events detected on the user's location, in a list sorted by date/time. Last ones on the top.

In the following, we list example mash-ups used for live news applications are:

- **Events detected on a Map**

The mash-up of the events detected list on a city geolocalized on a map using the coordinates of the place where each event is detected. The map is used to provide a quick view of the distribution of events in the city and gives the final user a quick picture of the status of the city in real time.

The visualization is achieved by placing icons on the map depending on the kind of event detected.

This is the main mash-up for the live news use case because it uses the main high level events inferred from physical sensors, social networks and external news feed.

- **Crowds distribution on a Map**

This mash-up uses the crowd density calculated from each edge node linked to a live video source as well as the check-ins from foursquare, to draw on a map the distribution of people in the city. This mash-up offers information on which are the most crowded areas on the city. Furthermore it can be used to infer that there is an irregular situation if crowds are detected at unusual locations.

Combination of data streams originating from foursquare and crowd analysis used to display in real time the more crowded areas of the city. Foursquare check-ins will be used as source of data for the areas where no sensors are installed.

The need of a definition of the threshold for both foursquare and physical sensors in each area to classify the crowds into:

- Low density
- Medium density
- Crowded
- Very crowded

A density of X in a place could be considered usual, and the same density could be considered an important data. Learning is necessary for each area where density is calculated must be done to be able to make more useful the information drawn in the map.

Not only raw data form crowd density must be displayed on the map, unusual data must be highlighted on the map to be able to make the results more useful for the final user.

- **Dominant Colors of the city represented in a timeline**

The main objective is to give a fashion point of view of the main colors detected on the city.

The results are represented on a timeline to give the user a view of the color tendency on the city and his evolution through the different days of the week, and the different weeks and months.

The representation of these data, are going to be on a timeline, displaying the main detected color of each day, with a main view of biweekly timeline, with the possibility to browse for color tendency on other dates.

- **Social discussion topics represented on a map**

The main objective is to display the topics of the social conversation on a map, the hashtags of tweeter could be the main source but other sources could be considered too.

This map gives the final user a real time summary of what his vicinity is talking about on social networks, it not only displays conversation about the city but also the global topic approached by user's from the city.

The interface of this mash-up is a word cloud geo-referenced on a map, with different size of the topics depending on the relevance and the quantity of social conversation about it. The map is going to be centred on the final user's location.

From the user interface perspective, the most important requirement is the adaptability to different devices; a liquid adaptive design is an option.

- For desktop browsers and tablets, the best option is to display a map, centered on user's location, with the events drawn on the map with icons indicating the type of event: crowd, accident, music, explosion, etc., (Event Map of the section 7)

The details of each event could be accessed by clicking on the event on the map (as described on the example off the section 7). Displaying a list outside the map is also considered.

- For the smartphones, we can hide the maps and display directly the list of events on the user's location (event-billboard described on section 7). Also include a drop-down menu to select an alternative location than the automatically detected.

5 Integration with the Search Layer

The SMART Search Layer is a core component in SMART responsible of providing effective and efficient real-time indexing and retrieval of social and sensor data streams. It is built with Terrier and the SmartReduce architecture using open source Storm stream processing framework to scale to a large volume of social and sensor streams produced by multiple edge nodes. More information on the Search Engine can be found in other deliverables of WP5 namely D5.1 for the SmartReduce Engine and D5.2 – D5.3 about the query processing techniques and the retrieval models.

Communication between the Search Layer and the SMART mash-up libraries developed in this deliverable is achieved through RESTful APIs. Each mash-up is associated with the data streams from the Search Layer API it may consume (based on the specific type of mash-up). Once one of these is selected by the end-user, it provides the data stream in a RESTful way for the mash-up to consume and visualize.

Widgets that consume the JSON responses from the Search API have already been developed. Using these responses the mash-up present the results of the search to the user through visualization.

6 **Mash-up Development**

The mash-up libraries are developed as portlets of the Liferay Portal; thus every authenticated user is able to deploy them on his personal dashboard and reuse them as many times as required. Upon deploying a portlet/visualization tool the user is asked to bind it with one of the appropriate data streams provided by an Edge Node Server. The mash-ups are developed using jChartFX and JQueryUI, two sets of open source Javascript libraries providing a collection of graphs and charts for data visualization, while the map mash-ups use the version 3.0 of Google Maps Javascript API. The connection between the Liferay Portal and the portlets is achieved through the internal Liferay APIs.

6.1 **Liferay**

The Liferay Portal, which forms the basis for the implementation of the reusable mash-ups, is a free and open source enterprise portal project providing a web platform with features commonly required for the development of websites and portals and is based in Java. Liferay includes a built-in web content management system allowing users to build websites and portals as an assembly of themes, pages, portlets/gadgets. The core consists of open source frameworks such as Struts, Spring and Hibernate. Simultaneously, the great flexibility of the platform enables the use other scripting technologies either Server-side or Client-side, such as PHP, Ruby, Python, Javascript, JQuery etc. to create portlets. In addition to the wide support for browsers, languages and databases, this platform supports a large range of operating systems such as Windows, OS X and Linux / Unix, thus removing restrictions on the use of operating systems and allowing future changes.

Concerning the user authentication, Liferay supports a large number of Single Sign On solutions (i.e. frameworks for authenticating and authorizing users only once, per browsing session) and standards, such as:

- Central Authentication Service (CAS)
- LDAP
- OAM / OID (Oracle)
- NTLM authentication
- OpenID authentication
- Atlassian Crowd
- OpenSSO authentication
- SiteMinder authentication
- Facebook authentication

Liferay uses a rich set of user interfaces built with Ajax technology to provide benefits such as relocation of portlets with simple drag-and-drop, dynamic portlet loader and style modulator allowing customization of colors, fonts and links without editing stylesheets or HTML.

Liferay is selected by SMART for the visualization and presentation mechanisms of the system in terms of its interaction with the end user. Depending on the use case to be implemented, the requirements in terms of mashup-us re-usability and positioning vary from one to another. Liferay provides a re-arrangement system controlled through a user friendly interface as well as re-usability of each mash-up multiple times if required. Also Liferay, as a web portal is accessible through web by every device with a browser and through the repositioning system every dashboard for every use case will not only comply with the use case requirements but it can correspond to the device's as well as it's user's needs.

6.2 **JChartFX and JQuery UI**

JChartFX is a powerful HTML5-compliant charting component. It empowers developers and designers by allowing them to harness Javascript to integrate attractive data visualization elements to their Web user interfaces. jChartFX provides true client-side charts that have been fully tested with every popular HTML5 compliant browser. It is consisted of a set of Javascript libraries providing the most complete

collection of charts and graphs for professional data visualization and analysis.

The main reasons behind the selection of this tool include its cross platform operation, ensuring that the charts and the other data visualization components will work in any browser and any device (such a Tablet or Mobile), its natural adaptability which allows it to accommodate to the user's preferred themes without a single line of code by reading and interpreting jQuery themes and CSS files to quickly adapt to the current page layout and designs as well as its easy programmability and high performance thanks to its lightweight framework.

jQuery UI is a JavaScript library that provides abstractions for low-level interaction and animation, advanced effects and high-level, theme-able widgets, built on top of the jQuery JavaScript library, that may be used to build interactive web applications. It is as easy to integrate in any web application as JQuery itself with plugins configured be up and running quickly while being flexible enough to evolve with the developer's needs and solve a plethora of use cases.

6.3 Google Maps Javascript API v3

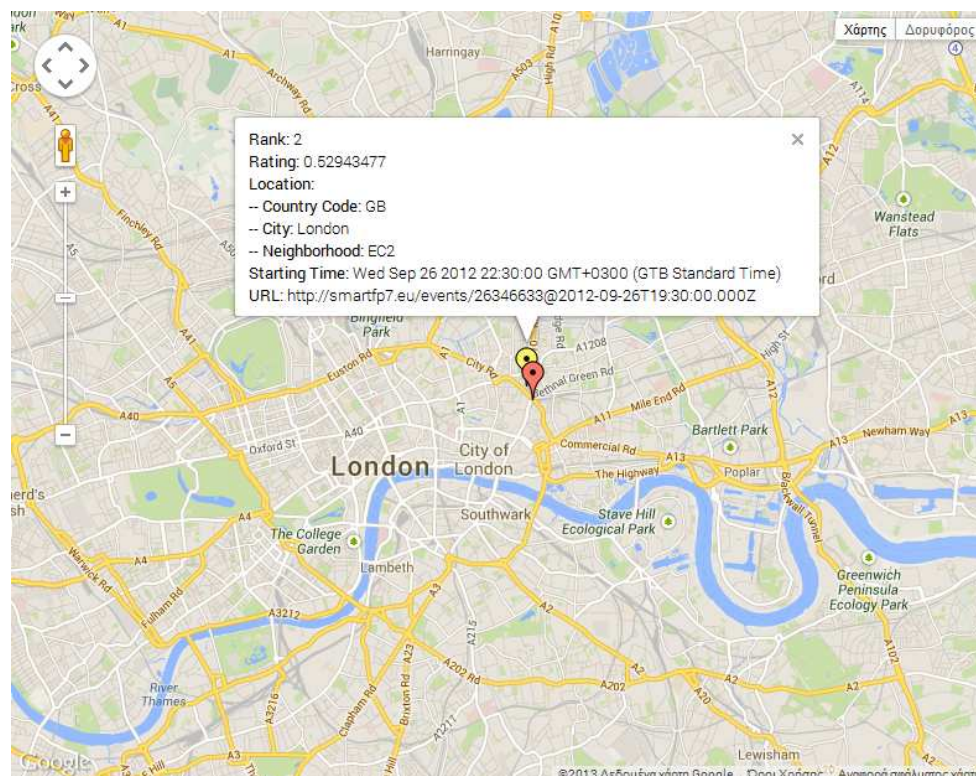
The Google Maps Javascript API allows the developer to embed Google Maps in any web page. Version 3 of this API is the latest official and is especially designed to be faster and more applicable to mobile devices, as well as traditional desktop browser applications. The API provides a number of utilities for manipulating map itself as well as adding content to the map through a variety of services, allowing the creation of robust map applications on any website. Google provides a much detailed documentation for the API which is provided as a free service, available for any web site that is free to consumers with a few limitations on the map refresh count per day and the number of points and sub-points shown.

7 Sample Mash-ups

Following is a list of mash-ups already developed to correspond to the project's needs. The fields in each table below that describes every mash-up include: The widget title giving a name to each of them according to its use, the number of variants it is able to receive as input (one or many), the type of measurement – i.e. whether it's discrete or scalar, the user controls defining what will be controllable by the end-user, some applications the mash-up can be used in, the description of an intended usage within the SMART project and finally a screenshot providing a first view of the mash-up using data somehow related or even completely unrelated to SMART.

Widget Title	Event-Map		
Number of Variants	Many	Type of Measurement	Discrete
User controls	Data-Stream Selection		
Applications Envisaged	Event View, Event Statistics		
Description of Intended Usage in SMART	The user will be able to view on the map all the events identified in the area corresponding to the Data-Stream he chose. Upon clicking in any event, information of that event will be provided in a pop-up.		

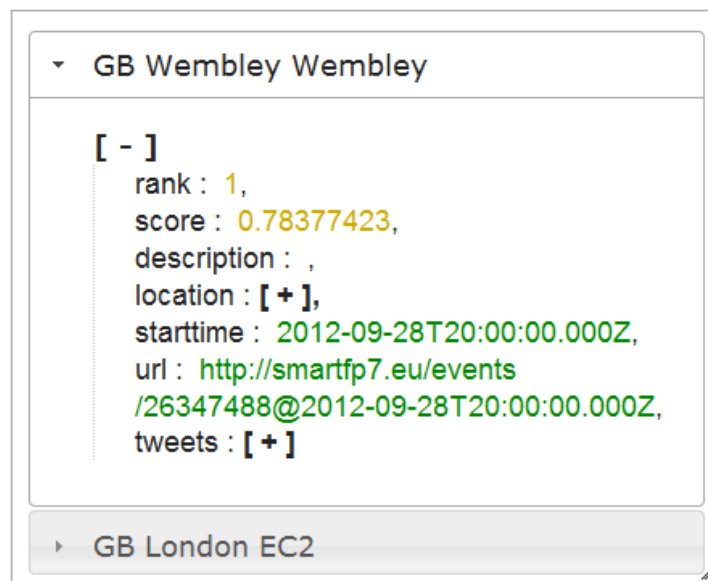
Screenshot



Widget Title	Event-Billboard		
Number of Variants	Max 10	Type of Measurement	Discrete
User controls	Data-Stream Selection		
Applications Envisaged	Event View, Event Sorting		
Description of Intended Usage in SMART	The user will be able to view the top 10 events automatically sorted from a Data-Stream that is chosen. Upon hovering the mouse on an event, more event information will be provided on a pop-up.		

Screenshot

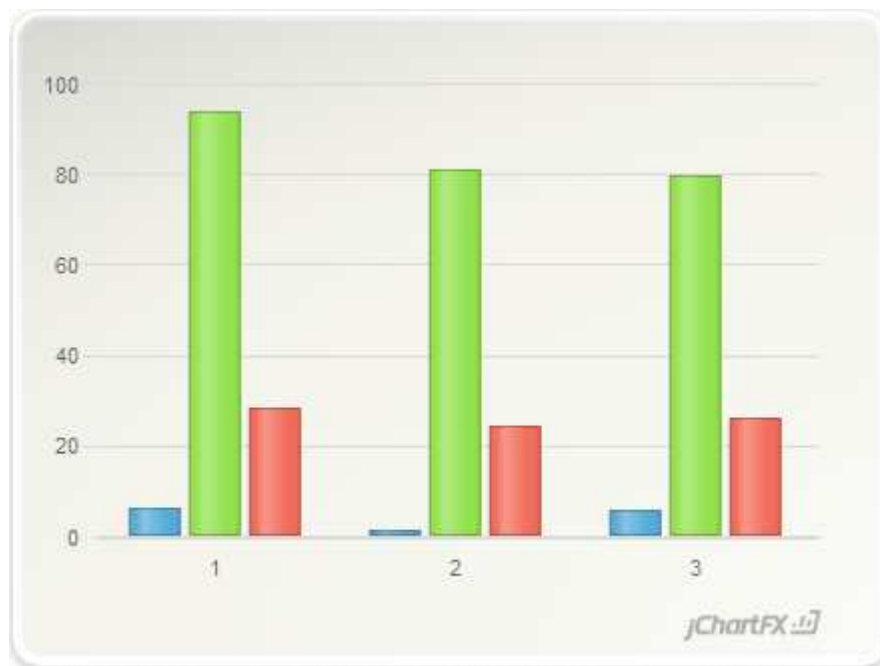
Query: "concert"



As an indicative example, the event-billboard widget screenshot above was taken after rendering a sample JSON response to a query from the Search Layer API searching on geo-tagged tweets on London back in 2012. For the query term "concerts", the API retrieved two results (events). Each event is identified by the estimated starting time and the location it happened while the top retrieved tweets that indicate the occurrence of those events are provided as well. For the locations returned, Yahoo! Where-on-earth-Identifiers are used to split London into different regions (neighborhoods). Other self-explanatory parameters are also provided though the fields are subject to modifications in future versions of the SMART Search API. The complete JSON response can be found in the Appendix.

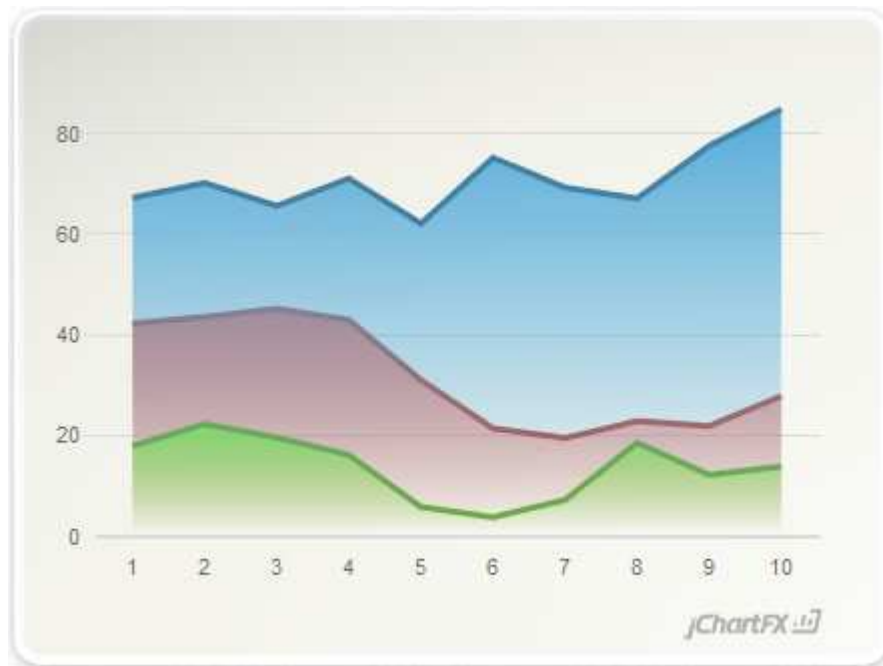
Widget Title	Bar-Chart		
Number of Variants	Many	Type of Measurement	Discrete
User controls	Multiple Data-Streams Selection		
Applications Envisaged	Temperature, Humidity, Head Count, Statistics...		
Description of Intended Usage	The user will be able to configure the widget selecting the Data-Stream(s) to be visualized and upon selecting the Chart will be drawn. The Y Axis will be the value of the selected measurement (e.g. Celsius Degrees for Temperature or percentage for Humidity etc.) while the X Axis will be the time of the measurement in most of the cases, or a group of sensors by type or location (e.g. The temperature sensors of a district compared to the ones of another district etc.)		

Screenshot



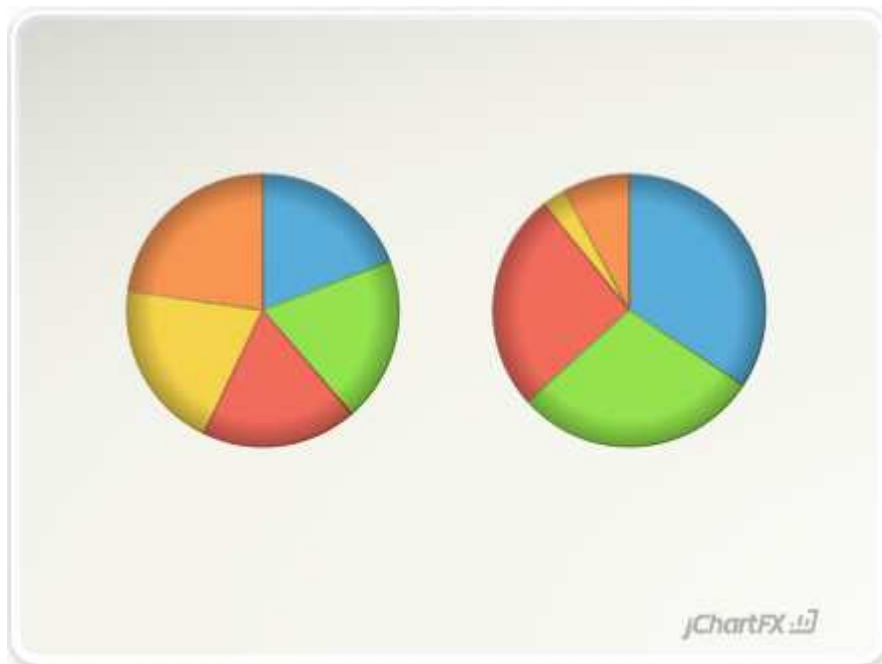
Widget Title	Area-Chart		
Number of Variants	Many	Type of Measurement	Scalar
User controls	Multiple Data-Streams Selection		
Applications Envisaged	Temperature, Humidity, Head Count, Statistics...		
Description of Intended Usage in SMART	<p>The user will be able to configure the widget selecting the Data-Stream(s) to be visualized and upon selecting the Chart will be drawn. The Y Axis will be the value of the selected measurement (e.g. Celsius Degrees for Temperature or percentage for Humidity etc.) while the X Axis will be the time of the measurement in most of the cases, or a group of sensors by type or location (e.g. The temperature sensors of a district compared to the ones of another district etc.)</p>		

Screenshot



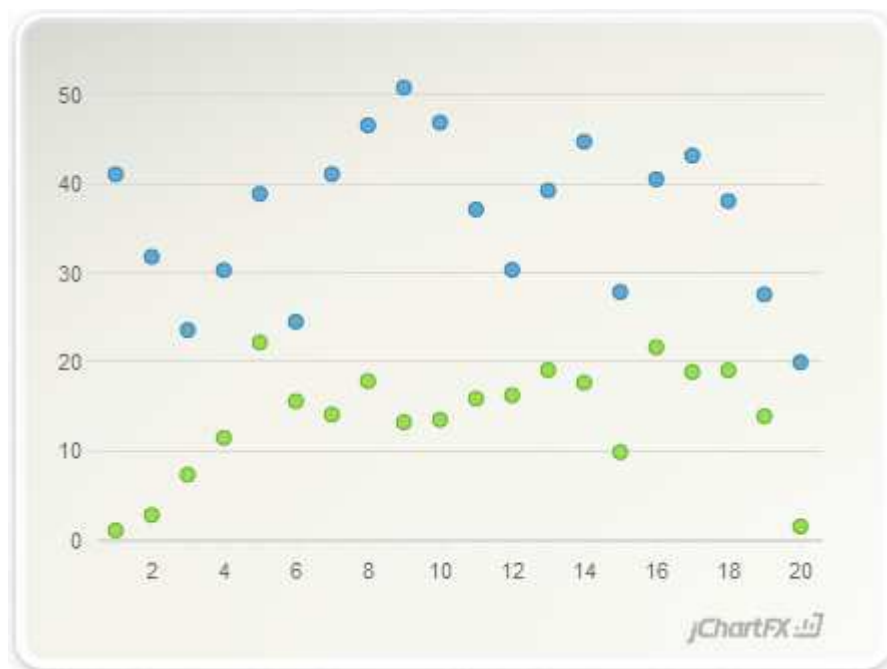
Widget Title	Pie-Chart		
Number of Variants	Many	Type of Measurement	Discrete
User controls	Multiple Data-Streams Selection		
Applications Envisaged	Head Count, Statistics...		
Description of Intended Usage in SMART	The user will be able to configure the widget selecting the Data-Stream(s) to be visualized and upon selecting the Chart will be drawn.		

Screenshot



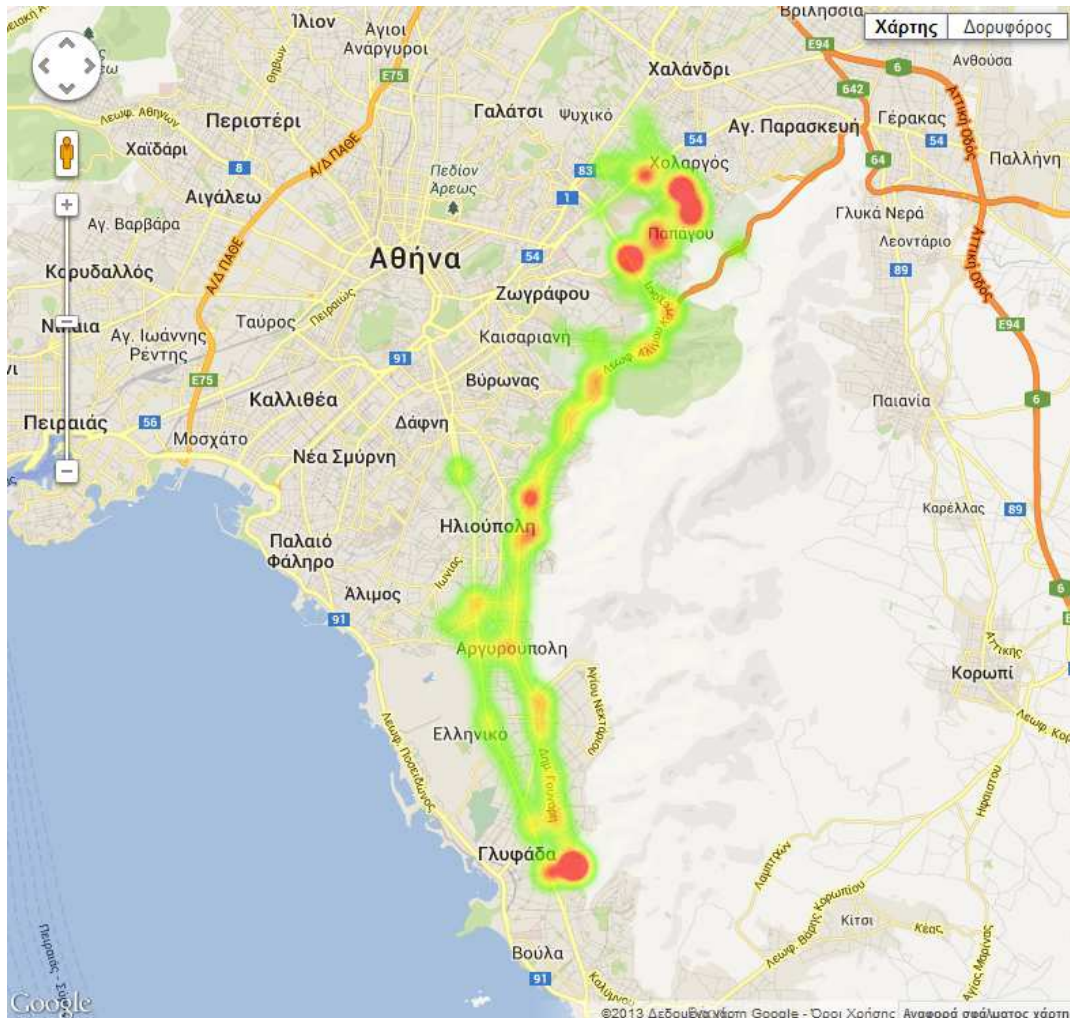
Widget Title	Scatter-Plot		
Number of Variants	Many	Type of Measurement	Discrete
User controls	Multiple Data-Streams Selection		
Applications Envisaged	Temperature, Humidity, Head Count, Statistics...		
Description of Intended Usage in SMART	The user will be able to configure the widget selecting the Data-Stream(s) to be visualized and upon selecting the Chart will be drawn. The Y Axis will be the value of the selected measurement (e.g. Celsius Degrees for Temperature or percentage for Humidity etc.) while the X Axis will be the time of the measurement in most of the cases, or a group of sensors by type or location (e.g. The temperature sensors of a district compared to the ones of another district etc.)		

Screenshot



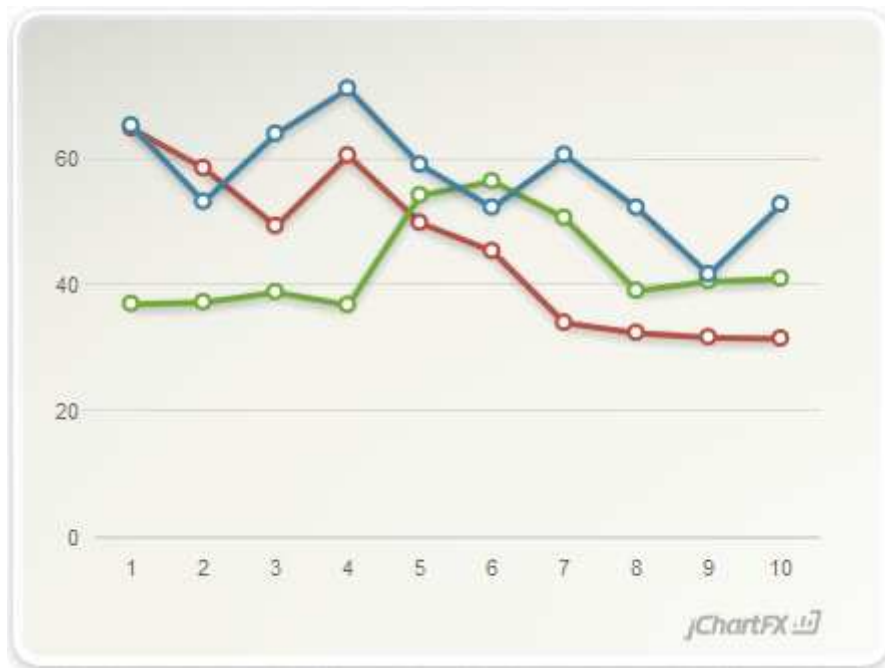
Widget Title	Heat-Map		
Number of Variants	Many	Type of Measurement	Discrete
User controls	Data-Stream Selection		
Applications Envisaged	Crowd Density, Social Data Density...		
Description of Intended Usage in SMART	The user will be able to view on the map the density of measurements in the area corresponding to the Data-Stream he chose.		

Screenshot



Widget Title	Line-Chart		
Number of Variants	Many	Type of Measurement	Discrete
User controls	Multiple Data-Streams Selection		
Applications Envisaged	Temperature, Humidity, Head Count, Statistics...		
Description of Intended Usage in SMART	The user will be able to configure the widget selecting the Data-Stream(s) to be visualized and upon selecting the Chart will be drawn. The Y Axis will be the value of the selected measurement (e.g. Celsius Degrees for Temperature or percentage for Humidity etc.) while the X Axis will be the time of the measurement in most of the cases, or a group of sensors by type or location (e.g. The temperature sensors of a district compared to the ones of another district etc.)		

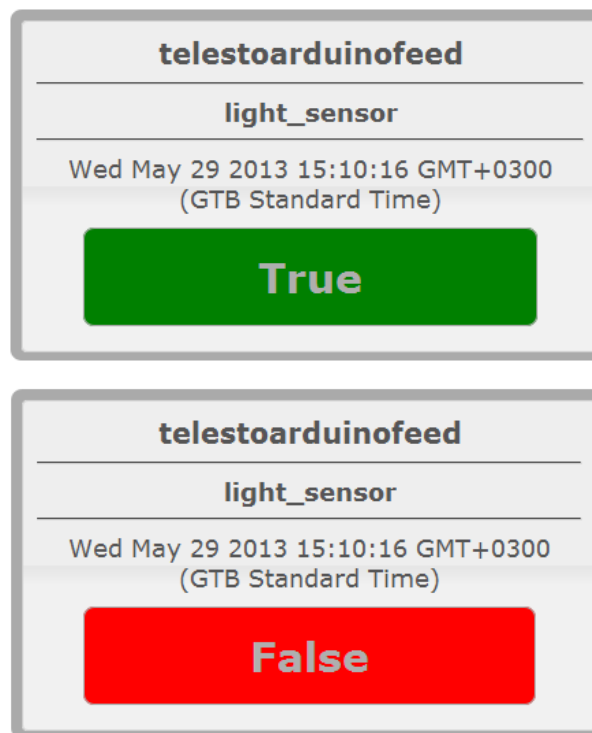
Screenshot



Widget Title	Simple-Display		
Number of Variants	One	Type of Measurement	Discrete
User controls	Data-Stream Selection		
Applications Envisaged	Temperature, Humidity, Head Count, Percentages ...		
Description of Intended Usage in SMART	The user will be able to configure the widget selecting the Data-Stream and view the value received.		
<div><div>Screenshot</div><div><div><div>telestoarduinofeed</div><div>temperature_sensor</div><div>Wed May 29 2013 15:10:16 GMT+0300 (GTB Standard Time)</div><div>27 Celcius</div></div></div></div>			

Widget Title	Boolean-Display		
Number of Variants	One	Type of Measurement	Discrete
User controls	Data-Stream Selection		
Applications Envisaged	Light, Power Supply, Event Activity...		
Description of Intended Usage in SMART	The user will be able to configure the widget selecting the Data-Stream and view the Boolean value received.		

Screenshot



The following table maps the various mash-ups to the Use Cases surveyed in SMART Deliverable 2.2 [SMART-D2.2].

#	Mash-Up	Indicative Use Cases (according to SMART Deliverable 2.2) in which this mash-up is involved
1	Event-Map	UC1.2 (Social trends), UC1.5 as well as in any use case that requires geo-referencing of events
2	Event-Billboard	Any use case which needs ranking of search results, e.g. UC1.2 (Social trends)
3	Bar-Chart	UC1.6 among others
4	Area Chart	Used to monitor any type of scalar value
5	Pie-Chart	UC1.3 (sentiment analysis), UC1.6 (color tendency)
6	Scatter-Plot	Any type of discrete reading
7	Heat-Map	UC1.1 (Social Density), UC1.4 (Crowd detection)
8	Line-Chart	Any type of discrete reading and/or percentage, e.g. UC1.3 (sentiment analysis)
9	Simple-Display	Display any type of value
10	Boolean-Display	UC2.5 (Sensor status)

8 **Conclusion**

The purpose of this deliverable was to address the visualization needs of the SMART project multimedia search engine. To this end we have examined both the needs of the partners who are also end-users through specific use cases, as well as the generic case where arbitrary needs have to be addressed. In the latter case we approach the generic needs through the development of mash up components, composing a dashboard which the user may customize (by repositioning and reusing instances of the mash up components).

The technologies and the tools described throughout the document were selected based on the needs of the use cases (ergonomy, usability, clarity in the display, control and input of information), and is offered as open source. Furthermore we have proceeded with a prototype use of selected mash-up components, for the intended use cases. In the next iteration of this document, and as the project continues, we will identify further functionality that may be best served by additional components.

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10 ANNEXES

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