

A SDI and Web 2.0 based Approach to Support E-Participation in Municipal Administration and Planning Strategies

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SUMMARY

Citizen's participation is commonly accepted as important, necessary and (in Germany and many other countries) to some extent required by law. Furthermore, existing and upcoming challenges like demographic change and monetary tightness call for the public's intensified involvement in municipal administration and planning. The internet is considered to be of particular value for additional participation. Following this assumption, various attempts have been made within the last two decades to deploy the World Wide Web (WWW) – partly combined with GIS functionalities – for supporting public participation in political and planning matters. Still, the adoption of GIS based tools for e-Participation in practice has been disappointing.

A number of recent trends that come under the heading of Web 2.0 raise hopes again, e.g. the popularity of Google Earth and Google Maps, social networking and mobile services like Twitter. If these trends (and the philosophy of the Web 2.0) could be used for political and planning matters, e-Participation might gain a new quality and reach a considerable number of additional citizens. Furthermore, Spatial Data Infrastructures (SDI) are being established throughout Germany driven by EU-directives. These lead to an increasing availability of qualified geodata (viz. data related to a spatial context), of which municipal administration and planning could benefit. Besides, combining SDIs and Web 2.0 trends generates an additional value with regards to municipal e-Participation's efficiency.

But in what way could GIS based e-Participation benefit from Web 2.0? What design would be adequate for a GIS based e-Participation tool using Web 2.0 technologies as part of a municipal SDI? These questions are answered within this article. Furthermore the intended implementation of such a tool in the City of Wiesbaden, Germany, is described.

ZUSAMMENFASSUNG

Die Partizipation der Öffentlichkeit ist eine weitgehend akzeptierte Notwendigkeit, deren Mindestmaß in Deutschland sowie in vielen anderen Staaten heute sogar gesetzlich vorgeschrieben ist. Bestehende Problemlagen (bspw. der demographische Wandel oder die prekäre Finanzsituation der Kommunen) dürften zudem die Notwendigkeit weiter verstärken, die Öffentlichkeit aktiv am administrativen und planerischen Handeln auf kommunaler Ebene teilhaben zu lassen. Gemeinhin wird dem Internet eine entscheidende Rolle in diesem Zusammenhang beigemessen – auch und gerade für den kommunalen Kontext. Dieser

Annahme folgend wurden in den vergangenen zwei Jahrzehnten zahlreiche Anstrengungen unternommen, das World Wide Web (WWW) – partiell in Verbindung mit GIS-Funktionalitäten – zur Unterstützung von Teilhabe in kommunalen Planungs- und Verwaltungsprozessen zu nutzen. Der Erfolg solcher Ansätze blieb bislang jedoch, gemessen an ihrer Adaption durch Bürger und kommunale Verwaltungen, eher enttäuschend. Neue Entwicklungen im Umfeld des Webs 2.0 lassen jedoch begründete Hoffnung für einen wachsenden Erfolg solcher Instrumente aufkommen. Ließe sich die Popularität von Google Earth und Google Maps, sozialen Netzwerken oder mobilen Diensten wie Twitter für die Partizipation in Verwaltung und Planung nutzen, könnte die Teilhabe der Öffentlichkeit eine völlig neue Dimension erreichen. Zudem bauen derzeit zahlreiche deutsche Kommunen, EU-Direktiven folgend, Geodateninfrastrukturen (GDI) auf. Daraus resultiert eine zunehmende Verfügbarkeit von qualifizierten Geodaten, von der das kommunale Planungs- und Verwaltungshandeln profitieren kann. Darüber hinaus ließe sich durch die Kombination von GDIs und Web 2.0-Trends ein zusätzlicher Mehrwert hinsichtlich der Effizienz kommunaler e-Partizipationsinstrumente generieren.

Doch in welchem Maße kann GIS-basierte e-Partizipation von Web 2.0 profitieren? Wie müsste ein entsprechendes Werkzeug unter Nutzung sowohl von kommunaler GDI als auch von Web 2.0 Prinzipien aussehen? Diese Fragen sollen nachfolgend beantwortet werden. Zudem wird die derzeit in Kooperation mit der Stadt Wiesbaden stattfindende Entwicklung eines solchen Werkzeugs beschrieben.

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1. THE GROWING RELEVANCE OF CIVIL INVOLVEMENT IN MUNICIPAL ADMINISTRATION AND PLANNING

Concepts like participation, civil society, the ensuring or enabling state have become widespread in the political, administrative and planning related discourse of democratic societies. The bottom line of these concepts is to assign the public with stronger responsibility for the common weal, while at the same time granting more capabilities for participating in the political and planning environment to it. Such a change of thinking with regards to the relationship between the state, the economic system and the civil society has become inevitable (Anheier et al., 2000). This necessity is driven primarily by two factors:

- 1.) Representative democracies suffer under the citizen's increasing disenchantment with politics and their declining identification with their representatives (Fürst et al., 2005).
- 2.) Many democracies need relief. They have shouldered too many duties and responsibilities over the years (Rohland, 2005).

Due to people's direct involvement on the local level, the concepts mentioned above are of exceptional relevance for municipal planning and administration. Furthermore, challenges like demographic shrinkage and monetary tightness call into question both, municipal services as well as accustomed planning practices. With regards to Germany – the focus of our research – those challenges are likely to grow, as Germany's population is going to shrink and age drastically within the upcoming decades. Enhanced participation of the civil society could be the key to the solution of this challenge. However, organizational adjustments and new technological developments seem to be the prerequisite to foster enhanced participation (Zillesen, 2007).

2. TRADITIONAL METHODS OF PARTICIPATION IN MUNICIPAL ADMINISTRATION AND PLANNING

Today, participation in Germany is guaranteed to a certain extend by law. Still, the kind of participation offered to citizens shows significant disadvantages in terms of procedure and logistics, which constrain the participation of the public: Citizens willing to examine the disclosure draft of a preparatory land use plan, e.g., can do so only during a defined time span and in a location determined by the public authority. Besides, the public body charged with planning tasks has to spent several efforts to execute the mandatory participation requirements – a plan's disclosure, e.g., has to be appointed, organized and conducted. Media disruption is an additional disadvantage that occurs in an ordinary planning process and is a consequence of maintaining most of the data digitally, but presenting the plan's draft and receiving any objections against it usually in a printed form.

A lack of efficiency in the context of participation is not unique to processes of formal planning as mentioned above. It also happens when informal planning instruments are used, as for example scenario planning, open council, etc.: Appointing, organizing and conducting the planning process costs time and, as the case may be, money for the organizer and the participant. To overcome the disadvantages of traditional participation and to involve an even broader public, new forms of organization and technology have to be developed. The internet is likely to play a crucial role within this context – especially for municipalities (Marcinkowski/ Irrgang, 1999). According to this assumption, plenty of efforts have been undertaken to utilize the WWW for municipal issues within the last two decades. Generally speaking, a broad spectrum of instruments for enhancing participation via the internet can be found today in both, research and practice (Sinnig 2003). Still, quantity and quality of these e-Participation instruments do not fulfill the requirements of the German public in administration and planning, as it was recently proved (EIU 2009). The necessity to improve the IT facilities of German municipalities arises furthermore from a juridical perspective: the EU-directive (006/123/EC) on services in the internal market commits the Member States to “ensure that all procedures and formalities relating to access to a service activity and to the exercise thereof may be easily completed, at a distance and by *electronic means*, through the relevant point of single contact and with the relevant competent authorities.” (Article 8). This directive is to be implemented on the level of the municipalities, which are the “relevant competent authorities” for this issue in Germany. Within this context, various German municipalities are establishing web based service platforms as part of the municipal e-Government to enhance the administration’s efficiency.

Due to the fact, that municipal administration and planning is strongly related to its spatial context, the application and the handling of geodata is a crucial concern for the efforts of enhancing municipal e-Participation facilities. The handling of geodata furthermore is of particular importance for the connectivity of the e-Participation instruments to the requirements of both, the municipal administration and the public. In particular, the combined use of Geo Information Systems (GIS), Spatial Data Infrastructures (SDI) and Earth Viewers is a promising way towards improved e-Participation instruments, as it is shown below.

Combining the internet and geo information for participation purposes is not a new invention. A large number of research activities have been conducted in this context and several Public Participation GIS (PPGIS) and online Planning Support Systems (PSS) have been developed. In practice, the adaption of those tools has been disappointing though. This is, among other aspects, owed to the poor connectivity of these tools to the user’s requirements (Gertmann/ Stillwell, 2009).

3. PARTICIPATION 2.0 – NEW CHANCES FOR PPGIS AND PSS

A significant improvement of the WWW and a crucial advancement in terms of participation is the Web 2.0. Labeled as “*major release*” the Web 2.0 is based upon new interactive and collaborative elements, which dissolve the former distinction between (few) information providers and many information consumers.

4. OPEN GEO STANDARDS AND SPATIAL DATA INFRASTRUCTURES

The availability of geodata in the WWW has increased strongly, but not only thanks to the Web 2.0 and its (spatial related) applications or platforms. Currently, Spatial Data Infrastructures are being established on different administration levels (global, continental, national, regional and local) to enhance the access to distributed qualified geodata via the internet and to ease the integration of geodata in (new) applications. Especially the EU based INSPIRE process is driving this activity. In the near future a large number of qualified geodata (spatial base data, municipal and environmental related geodata, etc.) are going to be available via the internet. An important aspect for establishing SDIs is the use of open geo standards to ensure interoperability. Especially the standards that have been elaborated by the Open Geospatial Consortium (OGC) since the 1990ties have to be mentioned. For the access and distribution of geodata within one SDI, standards for geoservices, so called OGC Web Services (OWS), are specified. OWS ensure the access to distributed geodata via Hypertext Transfer Protocol (HTTP) and by predefined request and respond methods – frequently by applying XML. Geo Standards with a great importance in this context are:

- Web Map Services (WMS). These services allow the dynamical creation of maps – usually in a raster data format (JPEG, PNG, etc.).
- Web Coverage Services (WCS) enable access to geospatial coverages (e.g. Orthophotos).
- Web Feature Services (WFS) are interfaces for data access operations on geographic features. Transactional Web Feature Services (WFS-T) are a WFS variation that furthermore provides manipulation methods on geographic features.
- Catalogue Services (CSW) are services to publish and find geodata and geoservices based upon meta data.

The next step in the development of adjuvant SDIs is the integration of online processing services, who offer – unlike the data services shown above – diverse functionality for analyzing data via the web. A standard for Web Processing Services (WPS) has already been elaborated by the OGC. Another aspect likely to gain in importance concerning SDIs to come is – e.g. with respect to municipal planning – the access to and the distribution of 3D data and visualization. Currently, services that allow the visualization of 3D city models based on standards like VRML or X3D² are being developed (Web 3D Services, see GDI3D.de).

5. FROM WEB 2.0 AND SDI TOWARDS E-PARTICIPATION 2.0

The collaborative concept of the Web 2.0 and the increasing availability of (qualified) geodata via the web (Earth Viewer and SDIs) allow the development of modern online participatory instruments. Thus, promising possibilities with regards to the connectivity of those

² VRML = Virtual Reality Markup Language; X3D = Extensible 3D

instruments to the citizen's and the municipal administration's requirements are given. This aspect is emphasized by the following observations:

1. Due to Earth Viewers popularity the benefit that is offered by geodata has obtained access to the public's awareness. Google Earth and others offer geo information in a manner that fascinates and that is fun. Consequently, the user communities of Earth Viewers have become incredibly large in numbers.
2. Another Web 2.0 phenomenon is people getting involved and taking part in social networks like Facebook on a voluntary base. Not only social networks, but also online geoservices and games with a spatial relation, like various route planning services, Open Street Map or GeoCaching, are *hip* and are supported by numerous voluntary users. Voluntariness and the involvement of the *mass* on the other hand is the crucial aspect of a successful participation strategy.
3. Establishing SDIs allow the distribution of qualified geodata. Qualified geodata in turn are an essential part of administrative and planning processes in a municipality and cannot not be replaced by community based geodata or ones provided by the Earth Viewers.
4. OGC Geo Standards ensure interoperable access to geodata for anybody as an important aspect and a prerequisite for participation.
5. Integrating geodata within the framework of a municipal SDI ensures the persistent storing of the data gathered and prevents the losses of data, perishing in the "temporary space" of the Web.

The handling of spatial issues within the web can be fun, as shown by the observations 1. and 2. Quantities of users get fascinated by geodata and spatial concerns and become involved on a voluntarily base. If this hype could be used and applied for municipal administration and planning, an entirely new quality of e-Participation is likely to be reached. Chances are bright – at least if the new generation of e-Participation instruments is able to blend in with both, Web 2.0 technologies (observations 1. and 2.) as well as existing municipal IT infrastructures using SDIs (observations 3.to 5.) to prevent media disruptions.

Integrating Web 2.0 based instruments for e-Participation within municipal IT infrastructures is crucial for some other reason as well: One lesson learned from the success of the Web 2.0 is the necessity to base an e-Participation instrument only on few barriers, rules and obstacles. But community based approaches involve the risk of misuse and are therefore only partly applicable by e-Participation instruments. This problem can be illustrated with reference to the application "RottenNeighbor": Rottenneighbor.com is a Web 2.0 based application that was established in 2004 with its origin in the USA. It enables anybody to evaluate other people in a spatial related context. The evaluation is projected to the exact address of the referred "neighbor", presented on a Google Maps base and visible for anybody. Criticisms ("rotten neighbors") are marked red as positive results ("rad neighbors") are marked green. In addition, even pictures related to the assessed neighbors can be published. A glimpse at rottenneighbor.com shows that there are obviously much more *rotten* than *rad* neighbors and

that many of the evaluations are denouncing. This led to severe criticism by privacy activists and caused the lock of the website's access by most German internet providers.

To avoid these risks that come along with lax rules and barriers – without being forced to give up Web 2.0's advantages at the same time – Web 2.0 based e-Participation instruments are supposed to be integrated within the e-Government structures of a municipality. By this means, the municipality would be put in the position of the e-Participation's moderator and existing safety mechanisms could be applied to guarantee privacy and the data's security. An e-Participation instrument constitutes, by using this approach, an integral part of the municipal e-Government and – in a spatial context – can be considered as an additional dimension of a municipal SDI (see Fig. 2).

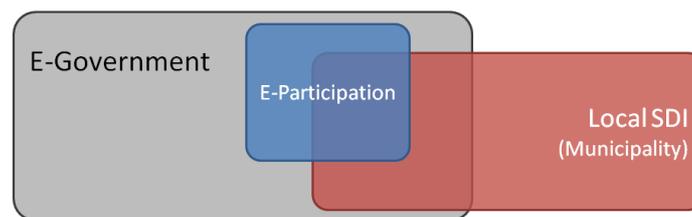


Figure 2: E-Participation as a integral part of the e-Government as additional dimension of a local SDI

With an eye towards technical implementation, evolving e-Government portals behave in a way similar to SDIs which were implemented with regards to SOA (Service Oriented Architectures) principles. In conclusion, these kinds of platforms seem to be adequate for ensuring the requirements of a digital procedures management for services, as demanded by the previously mentioned EU-directive 006/123/EC.

6. AN INTEGRAL E-PARTICIPATION INSTRUMENT IN ORDER TO SUPPORT THE MUNICIPAL ADMINISTRATION BY THE PUBLIC

As a reaction to the EU-directive 006/123/EC e-Government platforms and web portals are being established in Germany (e.g. e-Government Hessen) allowing the citizens to make use of public administration services on a local or federal state level via the internet. In cooperation with the capital of the Federal State of Hessen, Wiesbaden, this idea has been taken up starting with the development of a prototypical Web 2.0 e-Participation instrument as part of the existing municipal e-Government portal.

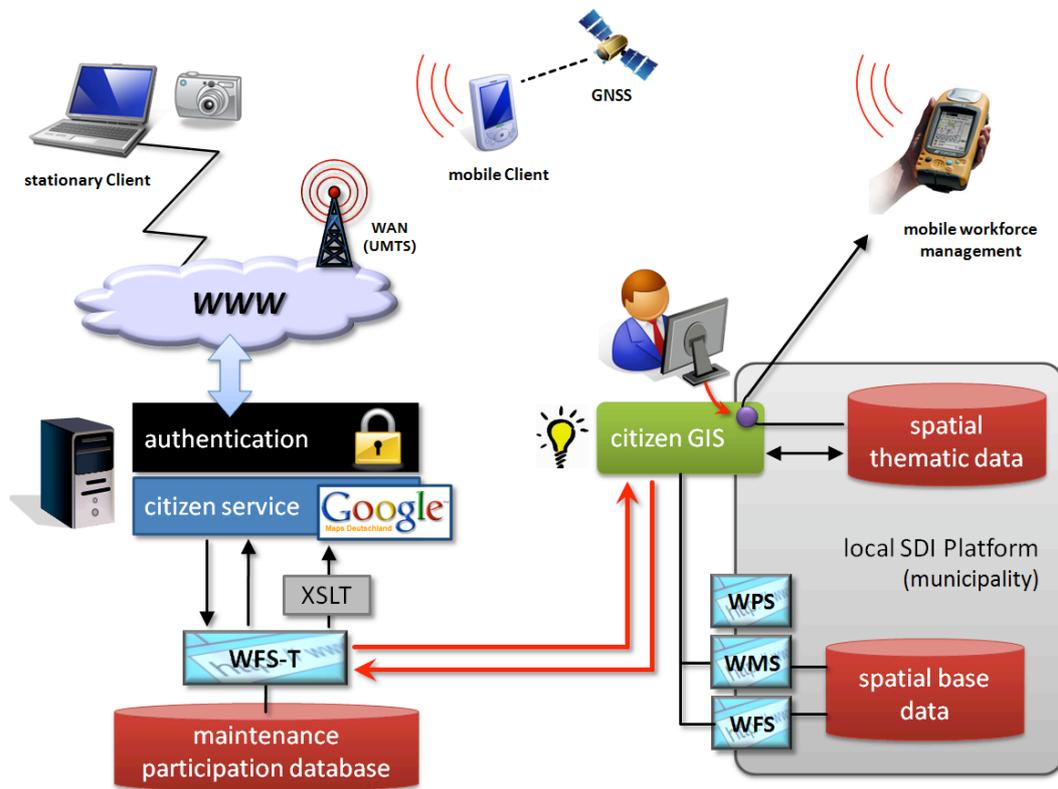


Figure 3: Web 2.0 based citizens' service as a part of a municipal SDI

As a first step, this instrument is supposed to enable Wiesbaden's citizens to inform the city administration about infrastructural problems (e.g. pot-holes, garbage, road lightning). By using this service the reporting citizen does not have to look for the telephone number of the right contact person in an inconvenient way or to send the incident's location imprecisely by a free text posting to an anonymous email address (without knowing the recipient and without notice of arrival).

Unlike existing Web 2.0 based applications with similar functionalities, the e-Participation instrument, which is called "Bürgerservice" ("citizen's service"), is supposed to become an integral part of the municipal SDI within the city's e-Government structures by the use of OGC standards. The designed "Bürgerservice" can be accessed via a web browser and can therefore be used at home as well. After starting the application a web form appears, in which predefined input fields and categories for the precise description of the problem are integrated. First, the reporting citizen selects a category, attaches a describing text and optionally a picture of the incident. The incident is located subsequently by pinning its location in Google Maps. Furthermore, already existing reports within the selected area are shown to prevent multiple reports of the same incident. Traffic light indicators (red / yellow / green) mirror the processing stage (red: report accepted, but not handled yet / yellow: in process / green: process finished) in order to make the processing stage transparent. After posting, the report is sent via a transactional Web Feature Service (WFS-T) and stored without media disruption in a geodatabase (see Fig. 3).

The visualization of reported incidents on a Google Maps is shown in Figure 4. By using standardized XML file formats (in this case GeoRSS) – which can be generated directly by the WFS using an Extensible Stylesheet Transformation (XSLT) for instance – allows the report’s immediate visualization in Google Maps.



Figure 4: Visualization of geocoded fault reports on a Google Maps base

In the following, possible extensions are described, which could enhance the efficiency and sustainability of the “Bürgerservice”. These extensions are currently under development respectively under consideration.

6.1 Mobile extension of the “Bürgerservice”

The inhabitants of the city using the e-Participation instrument described above are going to be provided with a state-of-the-art access to the “Bürgerservice”. It enables them to call the municipality’s attention quasi at walking past and on site by the use of a cell phone. This mobile interface requires fewer manual tasks, which in turn reduce time requirements and sources of error. Currently, the mobile interface is implemented through developing a client application for smartphones based on Java Micro Edition (JavaME), which runs on every Java-enabled cell phone. In an adequately designed GUI the users select a topical category and entering free text. The reports geocoding and its picture documentation can be done seamlessly using the smartphone’s embedded sensors, in this case GPS-receiver respectively its camera.

6.2 Potential for Integration of the “Bürgerservice” in municipal administration applications

The WFS enables also the direct access to the report data base from the city’s GIS applications (see Fig. 3). By merging the report with specific municipal geodata (relating to the city’s green areas or its street lights, e.g.), SDI-derived spatial base data (plots, traffic zones, etc.) and GIS analysis the contact person might have the ability to check the report’s integrity and set an editing status. Subsequently, he could delegate work order on a GIS level to the field staff, verifying and solving the reported problem on-site. Additionally, he could monitor the work process and manage the report’s digital status. After the problem is solved, the report ought to stay for a predefined time period in an active mode (e.g. seven days) and is then deleted from the data base automatically.

6.3 Security and Authentication

A necessary precondition for ensuring the instruments sustainability is the authentication of the citizen willing to use the offered service. Only a proper approval mechanism curbs potential misuse and makes sure that the user to be is actually an inhabitant of the city. To protect anonymity and privacy the fault report should not be personalized. For conducting the authentication the “Bürgerservice” is supposed to be integrated in the city’s existing e-Government platform and an approval mechanism has to be superposed. This approach assures the data’s security, e.g. by encoding the transferred data. The authentication in particular might be solved by using the ID number. Two authentication approaches are conceivable: 1.) If using a stationary client the user has to enter the ID number together with an automatically generated authentication code. Then, both codes are checked by the approval mechanism and only if the codes are valid, access to the service is granted. 2.) A mobile access could be implemented by using the ID’s machine-readable OCR (Optical Character Recognition) code. The user is granted access after the successful check of the OCR-code, of which he has taken a photo with his cell phone cam and has sent it to the server.

7. THE USE OF THE E-PARTICIPATION INSTRUMENT DESCRIBED IN THE COURSE OF MUNICIPAL PLANNING

E-Participation instruments are suitable for a variety of contexts (Hachmann, 2009). The multifunctionality of the e-Participation instrument described above is shown at this point with regard to planning processes in municipalities. The e-Participation instrument enables citizens to take part in planning processes via the internet and predefined web forms. By the use of a WFS-T based planning service the citizen’s criticism, comments and suggestions can be written in a database which is deployed in planning processes. Similar to the functionality of “Bürgerservice” the e-Participation instrument allows the geocoding of the citizen’s remarks in Google Maps. Again, traffic light indicators can be used to inform the citizen about the planning processes stage.

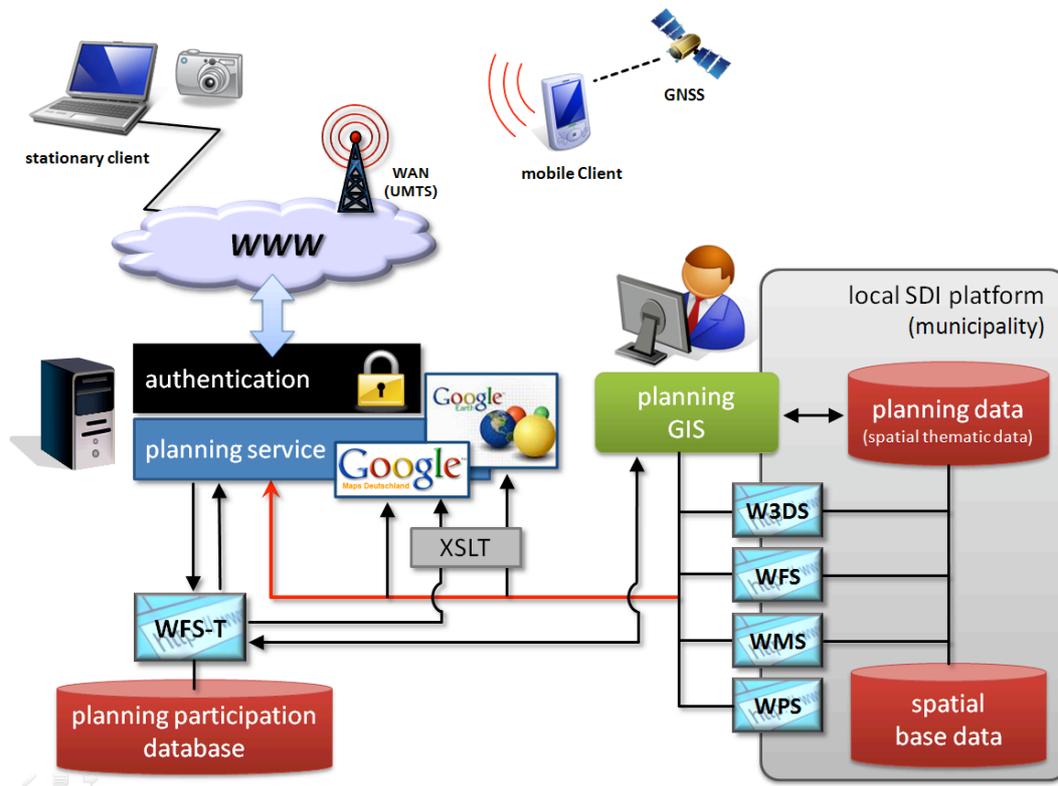


Figure 5: Web 2.0 and SDI based e-Participation instrument within the participation platform as part of municipal e-Services

To meet municipal planning demands, additional interfaces to spatial base data or qualified planning related data – e.g. by using the municipal SDI’s geoservices – are required to visualize a plans consequence in Google Maps. Following this approach a development plan, for instance, could be combined with a Google Maps image via WMS as a ground overlay. Enhanced visualization techniques like 3D representations, which could be applied with the aid of appropriate 3D geodata services (e.g. Web 3D Service) and file standards (e.g. kml) could facilitate the use of Google Earth and support the user’s imagination. In addition, the planning department could benefit by employing the same database via the WFS. This would allow the check or evaluation of the citizen’s remarks and enrich the planning process with people’s knowledge. Again a mobile extension is reasonable, because it enables the user to evaluate and comment a plan’s consequence on site.

8. CONCLUSION AND OUTLOOK

Collaboration between the public authority and the citizen is a basic requirement in a democracy. With the aid of the Web 2.0 promising new possibilities for creating e-Participation open up. Considering the development of state-of-the-art web technologies and applications like cloud computing or Google Wave even more dynamic Web 2.0 tools are

going to be available soon, which could lay the foundation for some kind of real-time e-Participation.

Using open geo standards and SOA allows the combined use of both, Web 2.0 principles as well as qualified geodata, of which the latter are inevitable for municipal administration and planning processes. Furthermore, this approach avoids data disruption and ensures persistent storage of the data gathered. Consequently, an e-Participation instrument in this context is more than a reasonable addition to a municipal e-Government platform – it can be considered as an integral part of a municipal SDI at the same time.

An additional benefit of this approach would be the universal availability of the (geo) data gathered and the interoperable integration in specific municipal software applications. This architecture could be used by further developments and processes, for example a Mobile Workforce Management to enhance the “Bürgerservice”. This enables the bidirectional communication (without media disruption) between the service manager and the field service person to support an effective fault clearing using mobile information and communication technology (e.g. wireless networks, mobile devices, etc.) as shown in Figure 3.

The “Bürgerservice” is currently developed and implemented in cooperation with the City of Wiesbaden. The developing process is conducted in team work with the city’s personnel to ensure the instrument’s usability with regards to both, the city’s personnel as well as the citizen. In the course of the process implementation specifics, e.g. authentication details are being elaborated. In perspective, the approach presented is supposed to be extended and transferred to further municipal processes.

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