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D21 - SURVEY OF M3W RELATED SYSTEMS, APPLICATIONS AND SERVICES

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Definitions, acronyms and abbreviations

| Acronym | Description |
|---------|---|
| AAL | Ambient Assisted Living |
| AALA | AAL Association |
| Aml | Ambient Intelligence |
| SWOT | Strengths-Weaknesses-Opportunities-Threats analysis |
| MWT | Mental Wellness Toolset |
| CBT | Community Building Toolset |
| PHS | Personal Health Systems |
| SP | Service Provider |
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1 Executive Summary

The aim of the project M3W – Maintaining and Measuring Mental Wellness is to catch the changing, mainly the declining of the mental capabilities. We intend to accomplish this by developing games which make possible to measure the mental capabilities, while the patients play these games with pleasure giving a chance for the systematic data logging. This can assist to determine the extent of the change in the mental state as exactly as possible.

The number of the people suffering from chronic diseases characteristic for the aged people increases as the average age augments. One of the cumbersome phenomenon typical for the diseases of the late years is the considerable mental deterioration, which makes difficult or even self-dangerous not only the life of the patient but causes an almost intolerable burden for his/her family or entourage. As the progressive attenuation of the mental capacity is a natural phenomenon in the late age, it is not a simple task even for the specialists to distinguish between natural and abnormal, and it is almost impossible for the long run for the people living together with the elder or knowing him/her closely. This report is Deliverable D21 of the M3W project. It describes and analyses the state of the art in all areas related to the project M3W.

This chapter is the Executive Summary. Chapter 1 introduces mental health and wellness web services, Chapter 3 analyses health and wellness related information services. Chapter 4 presents online collaboration tools, and state of the art technologies, focusing on Web 2.0 applications. Chapter 5 examines the web of gaming and the web games technologies and services. Chapter 6 presents and suggests guidelines and conclusions on the standards and technologies that may be used as part of the M3W project. These guidelines and recommendations drive the design of the M3W platform in the most suitable way, according to the market and technology trends.

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2 Mental Health and Wellness Web Services

2.1 Overview

The M3W project's ultimate goal is to develop a mental wellness toolset for self-usage, allowing to measure and visualize mental changes in an entertaining way, and give indications to the elderly persons, their relatives, friends, family caregivers and health professionals. Two main branches are developed:

- a) a Mental Wellness Toolset (MWT) to be used as a set of entertaining games capable to provide cognitive training and to measure and give feedback on the cognitive capabilities of the elders and
- b) a Community Building Toolset (CBT) to contribute a comprehensive, easy and collaborative access and sharing of patient's mental health data for all the authorized stakeholders (health professionals, family caregivers) and ultimately the patient itself.

Thus they will gain managed access to essential mental health information subject to the patient's consent.

This goal of the M3W project embeds many challenges; however we can highlight the two main categories of particular interest:

- a) Self-usage of a device to monitor health indicators and
- b) Sharing of health related information.

In the first category, the envisioned *device* is an entertaining application - a set of games. Here, the emphasis is on the usability aspects, i.e. usable without previous knowledge, and easily accessible (or provisioned), i.e. without restrictions, to everyone. Furthermore, the game should be operable by the patient and should be functioning in an uncontrolled environment, i.e. at home. In broader terms, the technology – devices and advanced information technology – to collect information about a patient's condition and enable people to age independently at home has been already individuate under the term Personal Health Systems (PHS; see e.g. Codagnone, Reconstructing the Whole: Present and Future of Personal Health Systems, 2009).

We describe in greater details the concept PHS and the associated technology and projects in relation to M3W in the State of the Art of Health and Wellness Applications.

In the second category - the sharing of health records - we are confronted to similar challenges as building eHealth systems in other EU projects. One of them is heterogeneity. Heterogeneity is found in education and culture with several languages, numerous legal frameworks and political organisations, different cultures and understandings. Interoperability, as a counter-measure to solve some of the problems heterogeneity creates, has many different dimensions, technical, organisational, political and legal.

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2.2 *History, markets and trends*

In 2008, the EC Communication on Telemedicine for the benefit of patients, healthcare systems, and society particularly highlighted the potential of telemonitoring which serves as an example for the benefits of the wide range of personal health systems. Interoperability and standardisation issues are recognised as crucial for telehealth services to spread further.

Following the Council Conclusions on eHealth in 2009, the European eHealth Governance Initiative (eHGI) was launched, to reinforce European cooperation at a high level and strengthen the common eHealth area. Four areas for joint efforts towards European eHealth interoperability have been identified: legal (including regulatory and ethics), standardisation/technical issues, semantics, identification and authentication.

The Digital Agenda for Europe, published in 2010, defines measures to use ICT to address – among many other challenges – rising healthcare costs and to help Member States to cope with their ageing populations. It underlines “the right of individuals to have their personal health information safely stored within a healthcare system accessible online” as an essential condition for successful uptake of eHealth and calls for actions to remove legal and organisational barriers, particularly those to pan-European interoperability.

In the spirit of these policy developments, a wealth of ICT projects has been funded within the European FP7 Programme for eHealth. In the following State of the Art of Health and Wellness Applications we describe a selected number of projects relevant to M3W.

2.3 *State of the art of Health and Wellness Applications*

2.3.1 Personal Health Systems (PHS) and PHS2020 FP7 project

The PHS2020 project funded by the European FP7 Program provided us with an extensive review on the state of the art in PHS. More importantly, the project elaborated four different scenarios in which the state of play has been compared to identify the gaps for Research and Technology Developments (RTD) to further research.

The PHS concept envisions a new generation of applications (i.e. wearable and portable systems) and tools in the hands of users and professionals and increasingly resting on the convergence between ICT and other technologies such as: biomedical sensors, micro- and nanosystems, user interfaces, and digital signal processing and intelligent algorithms.

As opposed to past activities focused on connecting the points of care (Regional) Health Information Networks, PHS is about connecting individuals with Health Information Networks. While this concept of PHS has been consolidated as one of the research priorities in FP5, FP6 and FP7, providing a consensual definition of what PHS are is difficult. Particularly challenging is to distinguish PHS in a clear cut way from other related concept one can find the relevant literature. Alongside the general and more widely used umbrella concept of Telemedicine, in the interdisciplinary literature on eHealth one can find a vast array of other terms and concepts such as “Telehealth”,

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”TeleHomeCare”, “Home Health Monitoring”, and “Personal Health Management”. Technologies and the supported service applications are often termed differently by different authors. In brief, the currently available definitions of the various concepts do not allow determining their taxonomic and clear cut relations.

2.3.1.1 Personal Health Systems Definition

Personal Health Systems (PHS) assist in the provision of continuous, quality controlled, and personalised health services to empowered individuals regardless of location. Codagnone (Codagnone, 2009) lists the PHS qualities as consisting of:

- a) Ambient and/or body (wearable, portable or implantable) devices, which acquire, monitor and communicate physiological parameters and other health related context of an individual (e.g., vital body signs, biochemical markers, activity, emotional and social state, environment);
- b) Intelligent processing of the acquired information and coupling of it with expert biomedical knowledge to derive important new insights about individual’s health status.
- c) Active feedback based on such new insights, either from health professionals or directly from the devices to the individuals, assisting in diagnosis, treatment and rehabilitation as well as in disease prevention and lifestyle management.

We first remark that the definition embodies two dimensions.

First, the definition underlies the vision of increasing the Empowerment and “Response-Ability” for individuals to take as much as possible health matters into their own hand and secondly, the definition brings a truly holistic vision of both individuals’ health and of the various components of PHS. Codagnone says “PHS reconstruct the whole and in doing so they reflect the new vision of complexity that is behind science in the 21st century”. This definition, albeit a consensual one, does not oppose the potential fully empowered self-caring individual on one side or the healthcare system organisation and professionals) on the other. It captures both of the two basic service delivery models depicted in the next two pictures.

The model of Figure 1 Service delivery model: healthcare pushed, source (Codagnone C., 2009) describes a situation where the service is initiated and led within the healthcare system but the initiator could be any other organisation or professional formally part of the healthcare system.

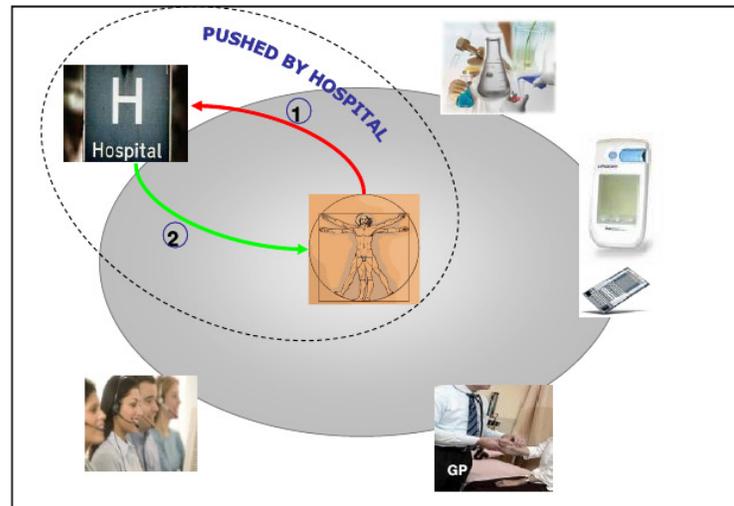


Figure 1 Service delivery model: healthcare pushed, source (Codagnone C., 2009)

In the next model depicted in Figure 2 Service delivery model: healthcare led by user, source (Codagnone C., 2009) the ownership of the PHS enabled care service is fully taken by the individual and the focus is on empowerment. Technology helps each person to manage certain health matters on his/her own, with reduced or no need of direct intervention on the side of healthcare professionals, naturally under well defined and controlled conditions.

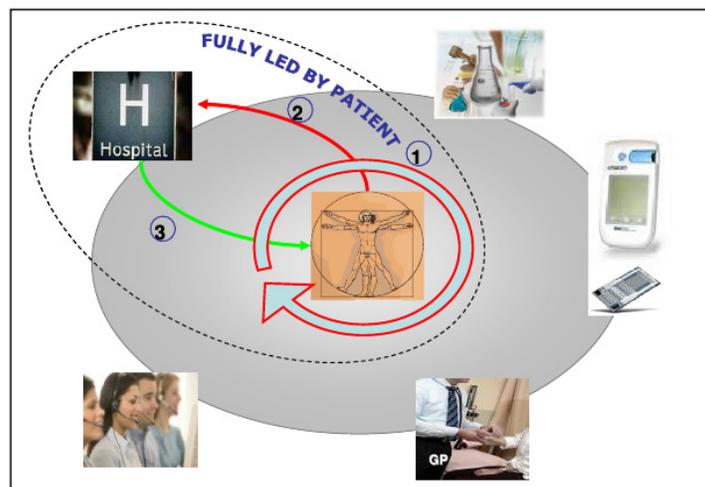


Figure 2 Service delivery model: healthcare led by user, source (Codagnone C., 2009)

2.3.2 Smart Personal Health (Support Action FP7-248419)

The key issues driving the SmartPersonalHealth activities are:

- a) raising awareness and
- b) understanding the concept and values of interoperability amongst key players.

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This is seen as a fundamental initial step towards key players, requiring and implementing interoperable PHS when establishing national, regional or individual solutions and applications. (Veli, 2011)

While other European initiatives¹ are addressing various policy, legal, technical, semantic and organisational issues of interoperability, SmartPersonalHealth aims primarily to promote the value of interoperability in PHS. The specific objectives were to not only put this endeavour into the overall context of European eHealth policy and implementation strategies, but to also involve relevant stakeholder groups, raise awareness about the existence and scope of various European and international interoperability initiatives, guidelines and standards, and optimise stakeholder input to further policy development in this crucial field.

SmartPersonalHealth actively engaged with and leveraged the experience of a multiplicity of stakeholders (health professionals, device manufacturers, systems integrators, eHealth industry at large; current and future potential procurers of PHS and other eHealth systems in the EU; SDO (Standard Development Organisations) representatives, insurers, healthcare providers and patients). Key activities included three thematically focused regional stakeholder workshops, one central PHS interoperability workshop, and further promotion, networking and dialogue.

The need for and the numerous benefits of interoperable PHS, stakeholder concerns, major barriers and incentives required to accelerate the development and adoption of interoperable PHS systems were examined in detail.

2.3.3 Continua Health Alliance Design Guidelines

The mission of the Continua Health Alliance Design Guidelines is: “To establish a system of interoperable personal telehealth solutions that fosters independence and empowers people and organizations to better manage health and wellness.”

The alliance is comprised of technology, medical device and healthcare industry leaders dedicated to make personal telehealth a reality. Their overall objectives are: developing design guidelines that will enable vendors to build interoperable sensors, home networks, telehealth platforms, and health and wellness services; establishing a product certification program with a consumer-recognizable logo signifying the promise of interoperability across certified products; collaborating with government regulatory

¹ Cf. CALLIOPE – Creating a European coordination network for eHealth interoperability implementation - supported by the EU CIP-PSP Programme, <http://www.calliope-network.eu/>; In an open, stakeholder-driven process to identify key challenges and issues related to interoperability, CALLIOPE defined priorities for a European eHealth Roadmap. The Roadmap can be downloaded at <http://www.calliope-network.eu/Consultation/tabid/439/Default.aspx> See a detailed Standardisation Status Report at <http://www.calliope-network.eu/Portals/11/d4.3.%20std%20status%20report.pdf>. See also the FP7 funded project HITCH – Healthcare Interoperability Testing and Conformance Harmonisation, <http://www.hitch-project.eu> and eHR-QTN – a Thematic Network on Quality Labelling And Certification of EHR Systems, <http://www.eurorec.org/RD/index.cfm>; epSOS - Smart Open Services for European Patients, a CIP ICT - PSP Large Scale Pilot on cross-border eHealth interoperability developing European patient summary and ePrescription services, www.epsos.eu; STORK -Secure idenTity acrOss boRders linked, www.eid-stork.eu; RENEWING HEALTH (REgioNs of Europe WorkINg toGether for HEALTH) for innovative telemedicine services, www.renewinghealth.eu

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agencies to provide methods for safe and effective management of diverse vendor solutions; working with leaders in the healthcare industries to develop new ways to address the costs of providing personal telehealth systems.

It should be noted that the MWT and the CBT being developed in the M3W project have no direct relations to Personal Health Systems as they do not collect and process physiological parameters measured by medical devices. Nonetheless, the experiences gained from the above mentioned and similar projects and initiatives are very useful also for the M3W project, especially in relation to the handling of sensitive data.

3 Health and Wellness Related Information Services

3.1 Overview

Health related websites are now amongst the most frequently accessed sites on the internet with current estimates indicating that there are now over 100,000 sites offering health related information². As a result of the wealth of information available and its apparent popularity, a number of organisations have begun to provide specific tools for searching, rating, and grading this information, while others have set up codes of conduct by which site providers can attest to their high quality services. The aim of such tools is to assist individuals to sift through the mountains of information available so as to be better able to discern valid and reliable messages from those which are misleading or inaccurate.

In the European Community, the purpose of the eEurope 2002 action on Quality Criteria for health-related Websites was to encourage the adoption of a common set of basic quality criteria for such sites. The issue of whether and how these criteria might be implemented at European level was not within the terms of the action. The implicit assumption was that this was a matter to be addressed in Member States at national or regional level, making use of the wide range of private and not-for-profit organisations which are already operating systems for implementing quality criteria for health-related websites.

3.2 Quality Criteria for Health Related Websites³

Recognising that European citizens are avid consumers of health related information on the internet and recognising that they are already using the types of rating system described above, the European Council at Feira on June 19-20 2000 supported an initiative within eEurope 2002 to develop a core set of Quality Criteria for Health Related Websites.

²Gunther Eysenbach, Eun Ryoung Sa, and Thomas L Diepgen "Shopping around the internet today and tomorrow: towards the millennium of cybermedicine British Medical Journal 1999; vol 319 pp 1294.

³COMMISSION OF THE EUROPEAN COMMUNITIES Brussels, 29.11.2002 COM(2002) 667 final, eEurope 2002: Quality Criteria for Health related Websites, http://www.hon.ch/HONcode/Webmasters/HON_CCE_en.htm

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3.2.1 Transparency of Health Related Content

Transparency of the health related objectives of the provider of the information, including the purpose and objective of content provision, should be clearly defined and stated.

Where advice or information on particular conditions, lifestyles or medications is given, funding from producers of products thereby implicitly or explicitly endorsed should be transparent to the site user.

Existing Community legislation already contains information and transparency requirements. For example Article 5 of Directive 2000/ 31/ EC on electronic commerce concerns the general information to be provided by an Information Society Services provider; Article 6 of Directive 2000/ 31 which concerns additional information to be provided in the case of commercial communications which are part of or constitute an information society service and Article 10 of Directive 95/ 46/ EC on the protection of individuals with regard to the processing of personal data and on the free movement of such data also applies.

3.2.2 Authority of Health Related Content Providers

Where a policy of using only accredited medical professionals to generate content is adopted, this should be clearly stated and adhered to.

Where a mixed group of content providers is used, (medical professionals, journalists, personal testimony, etc) the category of content provider of each item should be clearly identifiable.

Where scientific evidence is cited, the sources of such evidence should be easily identifiable to the user.

Where a medicinal product is recommended, EU legislation on Medicinal Product advertising should be adhered to, and any documents authorized by a regulatory authority should be made available to the site user.

Where advice is offered, the site provider should always include a reminder that internet based advice, whether personalized or not, cannot replace a face to face consultation with a healthcare practitioner.

3.2.3 Privacy and Data Protection of Health Data

Where any personal information is collected and further processed by the site user, including data processing invisible to the users, the requirements of Directive 95/ 46/ EC on the protection of individuals with regard to the processing of personal data and on the free movement of such data, in particular article 8 on sensitive and health data, should be carefully assessed and full compliance assured.

3.2.4 Updating of Health Related Information

Where specific health related data are provided, the relevance of such content should be regularly verified.

3.2.5 Accountability for Health Related Content

Where specific health related user feedback is provided by the site, particularly where personalised medical advice is offered, every effort should be made to ensure that such advice is bona fide and that advisors are suitably qualified to offer advice.

3.2.6 Accessibility in Health Related Content

Where a particular type of audience is targeted (e.g. children), the presentation and content of information should be appropriate to the chosen target audience.

The use of a metadata labeling system may be used to make health data more findable. Such a system may also be used in conjunction with quality criteria to give higher ranking by search engines to those sites or pages labeled as complying with defined quality criteria.

Applying International or European standards, wherever possible, is advised in order to facilitate notably the interoperability between different services and the cross-border provision of web based health services.

Table 1 sets out the resulting quality criteria.

Table 1 Quality Criteria for Health Related Websites

| Quality Criteria for Health Related Websites Developed in widespread consultation with representatives of private and public eHealth websites and information providers, other industrial representatives, public officials, and representatives of government departments, international organisations, and non-governmental organisations. These criteria should be applied in addition to relevant Community law | |
|---|--|
| Transparency and Honesty | Transparency of provider of site X including name, physical address and electronic address of the person or organization responsible for the site (see Article 5 and 6 Directive 2000/ 31/ EC on Electronic Commerce). |
| | Transparency of purpose and objective of the site |
| | Target audience clearly defined (further detail on purpose, multiple audience could be defined at different levels). |
| | Transparency of all sources of funding for site (grants, sponsors, advertisers, non-profit, voluntary assistance). |
| Authority | Clear statement of sources for all information provided and date of publication of source. |
| | Name and credentials of all human/ institutional providers of information put up on the site, including dates at which credentials were received. |
| Privacy and data protection | Privacy and data protection policy and system for the processing of personal data, including processing invisible to users, to be clearly defined in accordance with community Data Protection legislation (Directives 95/ 46/ EC and 2002/ 58/ EC). |
| Updating of information | Clear and regular updating of the site, with date of up-date clearly displayed for each page and/ or item as relevant. Regular checking of relevance of information. |

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| Quality Criteria for Health Related Websites Developed in widespread consultation with representatives of private and public eHealth websites and information providers, other industrial representatives, public officials, and representatives of government departments, international organisations, and non-governmental organisations. These criteria should be applied in addition to relevant Community law | |
| Accountability | Accountability - user feedback, and appropriate oversight responsibility (such as a named quality compliance officer for each site). Responsible partnering - all efforts should be made to ensure that partnering or linking to other websites is undertaken only with trustworthy individuals and organisations who themselves comply with relevant codes of good practice. Editorial policy - clear statement describing what procedure was used for selection of content. |
| Accessibility | Accessibility - attention to guidelines on physical accessibility as well as general findability, searchability, readability, usability, etc. |

The list of criteria above is designed to be applicable to the development and maintenance of a health related website irrespective of the type of information or audience to whom the information is targeted. However, one essential quality criterion is that a health-related website should state clearly what is its target audience and that care should be taken to ensure that both the style and nature of the information, and its presentation, are appropriate for the chosen audience.

When tailoring the content to a chosen audience, a number of factors should be borne in mind in addition to those set out above which should govern the construction of a site. These factors may be considered under the same broad headings as the general site development criteria.

3.3 *Health and Wellness Related Information Services Market and Trends*

With the establishment of the Internet as a general information medium, also a wealth of health and wellness related information has appeared. Beside general health information, forums and chat services exist enabling private persons to exchange and discuss health topics.

A growing number of Internet providers of health services are opening up help desk service on the Internet to answer e.g. Swiss citizens' questions. Furthermore, previously inaccessible information, such as MEDLINE or drug information databases, are opening up to the general public. Interactive services based on Web 2.0 up to the access to Health Records are slowly taking over the above general services.

Hungarians can also access drug information databases (e.g. that of the Hungarian National Institute of Pharmacy, see http://www.ogyi.hu/drug_database/). One of the most popular health related websites in Hungary is Házi Patika (Home Pharmacy) (<http://www.hazipatika.com>), offering popular descriptions of common diseases, medical examinations and therapies, advices for healthy living, nutrition and prevention, searchable drug information, medical dictionary, etc. Persons who have a Hungarian

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social identity code can access an official database where all their past medical interventions are listed in chronological order, as well as prescribed medicaments bought by them in pharmacies (see <https://ugyfelkapu.oep.hu>). They may share the latter information, if they want to, with their pharmacists who this way can check for possible unwanted interactions.

In Switzerland and Hungary, for example, the common providers of health related portals are:

- Public institutions, incl. ministries and governmental offices
- Healthcare Service Providers
- Media and Publishing Companies
- Manufacturers and distributors of pharmaceutical products
- Scientific organizations
- User communities

However, the amount of people surfing the Internet is constantly growing. According to the Internet World statistics, nearly two billion people, or 28.7% of the world's population, are using the Internet⁴. The numbers vary from one region to another, in North America, 77.4% of the population is online, with numbers growing steadily for the past ten years (146% growth between 2000 and 2010). In Africa, only 10.9% of the population uses the Internet, but the growth was 2357% over the past ten years.

Europe (as a geographical region) accounts for almost a quarter (24,2%) of the world Internet user community. The Internet penetration across European countries is 58,4% (2010) and the growth in Internet use for the period 2000-2010 has been 352%. The biggest Internet user communities are in Germany (65,1 million), Russia (59,7 million), the UK (51,4 million) and France (44,6 million) in 2010. The highest Internet penetration was noted in the Northern European countries⁵. Since its inception, the Internet has been used for health purposes and the trend is growing steadily. 59% of the American population looked for health or medical information online in 2011⁶. According to the Harris Poll the percentage of all US adults who have ever searched for health or medical information online has increased from 27% to 76% from 1998 to 2010 and the percentage of those who do it sometimes or often (on average 6 times a month) increased from 42% to 73%⁷. There are no aggregated statistics for the EU countries. The first cross-country European study showed a relative growth from 14% to 39% in the 2005-2007 period. More recently, national bodies reported in 2010 that 52,5% of adults in Spain were looking for health content on the Internet and 39% in the UK⁸. The following chapter reports health content on the Internet for Hungary which extend the previous surveys.

⁴ <http://www.internetworldstats.com/stats.htm>

⁵ <http://www.internetworldstats.com/stats4.htm>

⁶ http://www.pewinternet.org/~media/Files/Reports/2011/PIP_HealthTopics.pdf

⁷ <http://www.harrisinteractive.com/vault/HI-Harris-Poll-Cyberchondriacs-2010-08-04.pdf>

⁸ <http://www.statistics.gov.uk/pdfdir/iahi0810.pdf>

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3.3.1 Traffic and Usage of Health Related Content in Hungary

The total traffic volume on health related portals is continuously increasing. In 2011 the traffic increased 25% compared to the previous year. Health related portals reached 26% of the total 6,2 million internet users in Hungary, that is 1,6 m users. On an average day, about 120 thousand users find information relating to health topics on the internet. Health related portals in Hungary provide relatively broad reach also in international terms. The 26% value is higher than the West European average. Health related users are present on several health related websites, they collect information from different sources.

The top 5 health related portals are listed in the next chapter, including data about traffic and commercial issues.

About 65% of all visits may be regarded as active interest, that is about 2/3 of all visitors of health related portals (1 million visitors) do targeted activity to reach health related information on the web. The visitors of health related portals have specific information need: they search specific topics with no systematic method, but they gather information from a wider range than the average user.

The total traffic of health related portals increased some 25% from 2011 to 2012, taking into account the 10 largest health related portals.

In comparison to other countries, the ratio of internet users who visit health related portals at least once a month is high in the Hungarian market. It is an interesting phenomenon that this value is lower in Western-European markets than in most countries in our region. In Poland, Czech Republic, Romania, Ukraine the interest towards health related portals is similar to Hungary, while these indicators are lower in the Balkan.

There are several reasons behind the traffic volume increase of health related portals:

- Internet-penetration. the increase of traffic is less than 30% due to the increase of internet usage.
- Demographic components of penetration increase. In the last years, internet usage increase continued within the middle age and older population. Among new entrants, the interest towards health topics is higher.
- Cross-traffic. Health related portals benefit more from the expand of internet usage, since the internet users typically gather information relating to health topics from several sources, searching for information at more content providers' pages.
- General interest. In our region, in comparison to other countries, a lot of internet users visit health portals. This phenomenon may be correlating to the health status of the population and the standard of the healthcare system.
- Capital in the content provision. Similar to last years, in the first half of 2011 new health portals have been launched (Egészségtükör.hu, Betegvagyok.hu), while the majority of market leading portals increased the online marketing spending through purchased traffic sources.

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3.3.2 Health Related Information Channels to General Audience

It may be reasonably supposed that the target audience interested in health topics might be reached through portals of other topics with the same hit-rate, primarily life-style, wellness and feminine portals may have the same audience. What can we know about these visitors and their relation to health portals?

To get an answer, we examined the cross-traffic between the health portals and those portals having some connection to health topics.

The cross-traffic between life-style portals dealing primarily with health topics and the health portals is fairly high, that is the visitors of the two groups of portals overlap greatly.

There were only 300 thousand visitors out of the 1.9 million combined audience who visited only life-style portals, while there were 800 thousand unique visitors who visited both portal groups.

It should be noted that 85% of the monthly 1.9 million unique visitors (1.6 million) can be reached through the health portals of narrower sense, categorized by stricter criteria, moreover, the largest 4-5 health portals can reach 70% of the total volume of visitors!

Within the audience of feminine portals, it is about an equal number, some 1.2 million visit and do not visit health portals as well.

While the majority of health portal visitors show up on feminine websites, some 400 thousand unique visitors, interested surely in health topics can be reached only through health portals, since they do not belong to the visitors of feminine pages.

3.3.3 Visitors of Health Related Portals: Attributes of Information Gathering

Besides the volume of visitors interested in health topics the quality of interest is also a critical indicator. The significant volume of visitors measured by quantitative indicators differentiates health related portals also in quality from other population reached through different internet channels.

3.3.4 Active and Passive Visitors

The most important sources (from where visitors arrive to a given content provider's page) of health portal visitors are the followings:

- Search engines (Google, etc.)
- News aggregator pages (Hírkereső, Hístart)
- Direct visitors
- Other (community pages, link collections, newsletters, advertisements)

Search engine traffic should be highlighted in case of health portals, which is a characteristic of thematic portals, in contrast to news portals building upon actual information, or community sites (where this value is typically around 10%).

This fact should be regarded as an advantage for health sites, since targeted, active visitors who search for a limited number of real, health-related problems using one of the search engines can be served with proper content.

In the analysis, direct visitors, who supposedly did targeted activity, and search engine traffic were regarded as active visitors, while visitors arriving from news aggregator pages were regarded as passive visitors.

Based on the calculations, about 65% of total traffic can be regarded as active interest (4.5 million visits per month), that is, specific, targeted activity to gather health-related information on the web. In about 35% of total traffic, this intentional information gathering aim probably does not exist. However, even these visitors read articles and have resort to services occasionally if they find health-related information on the web.

3.3.5 Internet Usage Habits

Visitors of health related portals visit 2.3 thematic portals on average monthly according to our calculation.

Cross-traffic indicator is higher than in case of other portal groups. This indicator in case of life-style portals included in the research was 1.6, and 1.9 in case of feminine portals. The value indicates how many portals of similar topics were visited by a visitor on average in the month. (Google Adplanner: average of June-July 2011).

Table 2 summarizes the indicators relevant to the habits of internet usage based on weighted data by Google Adplanner. Table 2 Quality Internet usage habit indicators

| Average value by unique visitor | |
|--|-----------|
| Number of visits | 4,4 visit |
| Number of portals visited | 2,3 site |
| Returning (visits on the same site) | 1,9 visit |
| Page visit | 8 PV |
| Time spent on health portals | 14 min |
| Time duration of one visit | 3,3 min |
| Depth of one visit | 1,9 pages |

We may reasonably conclude from this data that it is typical in case of health-related information that visitors do not only search information at one content-provider, but learn about a problem searching at several portals parallel.

International surveys affirm this phenomenon: according to the survey of Health On the Net Foundation, only 10% of internet users accept the information provided by the first source, 55% use internet to find several sources of information (Pletneva, et al., 2010 August).

3.3.6 Summary

In the next sections we summarize some actual trends relating to the habits of visitors gathering online health related information on the web.

3.3.6.1 Information Channels in Healthcare

Regarding the primary source of information about specific diseases there are two sources standing out to a great extent: the general practitioner is regarded by 36% of adult population as primary source in this context, and the internet by 35%. The priority

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of channels is different by the different age groups: the web has the priority within the younger generation, about 50% of the population, between 18-45 years old, regards the internet as the primary source, when it comes to health. Within the older generation, the general practitioner has the same role.

It can be noted that the specialists, general practitioners, pharmacists, and the internet have leading role regarding access to health related information.

Another important question is how reliable these sources are regarded by the consumers. In terms of importance and reliability, beyond the mentioned information sources nurses play an important role, too.

The reliability and authenticity of the internet, even if at a slow pace, improved in the last years. In 2007 the value of the reliability index was 3.1 on a scale of 5, today this value is 3.4.

The same value within the consumers using the internet regularly for information gathering is higher: in their case the value is 4 on average, and close to 40% of them finds internet as a perfectly authentic channel.

3.3.6.2 Health Related Information from the Net

Searching online health related information is common within the internet users, every fourth user regularly orientates by such a way in this topic.

Web-based search is more typical for women, while by age groups it is the eldest, who take the lead. In harmony with this fact, 30% of internet users with chronic diseases would search information regularly, in contrast to those, who have no health-related complaints (22%).

The ratio of visitors using internet for health-related information gathering have not changed in the last 2 years, 90% of them uses the web for such purposes every now and then.

In terms of specific sources of information, the general search sites take the lead: 30% of net users performing targeted investigation would always use these sources primarily when they look for something, 27% of them uses these sources very often. This source is particularly popular within the people between age 26 and 45, 40% is the ratio of them who would go this way first.

Market research data bolsters the fact that searching health-related information is most often motivated by the need for a description or a tutorial regarding a specific disease. One fourth of users looking for health-related information browse the web with such an aim. The number of those who look for knowledge regarding healthy life-style or prevention of diseases is similarly high.

It is interesting that the mentioning rate of both topics were close to each other in all age groups, while healthy life-style is particularly popular within women (34% of them often look for it, while only 19% of men do the same).

Frequent reasons of motivation are the need for descriptions related to identification, diagnosis of diseases, and information about scientific advancements.

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Data about doctors, institutions are more popular within the young, and as age increases, the ratio of those who have this kind of motivation for internet browsing is significantly less.

Every tenth “health-browser” is particularly looking for experiences of other patients related to a given topic, and this ratio is even higher among people with chronic diseases – it is around 20%.

3.3.6.3 The Impacts of Reading the Internet

Health related information read on the net motivates readers for beneficial and harmful things alike. Many (30%) buy medicine or curative products based on information acquired on the web. Relatively high the ratio of those (20%), who turn to a doctor imposed by the information, and 15% go to a check-up.

Negative effects include that 10% of users due to his/her own interpretation of the description read on the web – although it may had been necessary – did not return to the doctor, or simply stopped taking medication that was in progress.

Studying generic division of the above, it can be said that shopping medicine or curative product imposed by reading health-related information on the web is more popular among women (40%) than men (23%).

Among people with chronic diseases:

- at 10% of these people happened that they continued a previously stopped medication due to the information read on the net,
- nearly 20% made up for a previously missed medical check-up,
- however, 14% stopped taking medicine.

4 M3W Community Building Tools

4.1 Overview

One of the major objectives of M3W is to develop online community tools. In the advent of the Internet, many online social applications have been developed. Among them, Skype and MSN Messenger are standalone “desktop” applications. M3W focuses on the Web social tools that are mainly used for community activities since they need to run in the user’s browser and, in most of cases, without the need of any additional installation of software. The Web-based online social tools are mainly developed using the Web 2.0 technology. Web 2.0 is a trend in the use of World Wide Web (WWW) technology and web design that aims to facilitate creativity, information sharing, and, most notably, collaboration among users (WAG10). “These concepts have led to the development and evolution of Web-based communities and hosted services, such as social-networking sites, wikis, blogs, and folksonomies”, source: (WebEs10).

The Web 2.0 technologies are standardized by the WWW Consortium (W3C). Although the Web 2.0 term suggests a new version of the WWW, it does not refer to an update to any technical specifications, but to changes in the ways software developers and end-users use the Web. In the context of M3W, the participation in community activities

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means to integrate the applications environment into one common environment, incorporating Web applications and internet services in one experience where all services will be available through the M3W Server and the game environment.

The Web 2.0 based applications may include instant messaging, audio and video chat, file sharing, and online voting and polling. For audio/video chat the Flash software platform is commonly used, with a recent important move to HTML5. Other solutions that are commonly used are the Java Applet technology or the use of standalone applications which run on a Web browser and offers interoperability over different platforms. For instant messaging, online polling/voting and file sharing, Asynchronous JavaScript and XML (Ajax) are commonly used (van Kesteren, 2009). “Ajax allows the Web applications to retrieve data from the server asynchronously in the background without interfering with the display and behavior of the existing page”, source (AP10). The use of Ajax techniques has led to an increase in interactive or dynamic interfaces on web pages (Ajax10).

The communication modalities of most of the Web 2.0 applications are based on Simple Object Access Protocol (SOAP) [Gudg07]. SOAP is a protocol specification for the exchange of structured information in the implementation of Web services in computer networks. SOAP relies on the eXtensible Markup Language (XML) as its message format, and usually relies on other Application Layer protocols, most notably the Remote Procedure Call (RPC) and HTTP.

Finally, the current trend for the Web and Internet application servers is towards free and open source technologies. Apache HTTP Server [Apache10] is a reliable solution for the provision of online collaboration services. A very common combination of technologies consists of the Apache HTTP Server, the PHP language with the support of the MySQL [Mysql] database management system. Another commonly used server technology is the Tomcat Server [Tomc10].

4.2 *CBT general functionality*

The online community tools that will be available through the M3W Server or Servers, aim firstly at providing an attractive gaming experience and feedback to the user but will also include both real-time and offline communication tools like voice and video chat, messaging, and forum. M3W intends to extend the benefits of Web 2.0 applications into the field of internet applications in order to enhance the social presence and to offer a more realistic way of interaction between the users (e.g. party gaming). Most of the user’s interface will be developed according to the Web 2.0 programming model.

In the following sections, the state of the art of the above technologies is described in more detail.

4.3 *State of the Art*

In the following sections, the state of the art of the technologies related to online community tools are described in detail.

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4.3.1 Web 2.0 Services and Technologies

The term "Web 2.0" [Tech08] is commonly associated with Web applications that facilitate interactive information sharing, interoperability, user-centered design, and collaboration on the World Wide Web. A Web 2.0 site allows its users to interact with each other as contributors to the website's content, in contrast to websites where users are limited to the passive viewing of information that is provided to them. "Examples of Web 2.0 include Web-based communities, hosted services, Web applications, social-networking sites, video-sharing sites, wikis, blogs, mash-ups, and folksonomies", source [Web10].

More importantly, applications based on Web 2.0 offer online interactions with other users. Collaboration in technology encompasses a broad range of tools that enable groups of people to work together including social networking, instant messaging, team spaces, Web sharing, audio and video conferencing.

The following subsections describe the main technologies found in today's Web 2.0 applications.

4.3.1.1 Actionscript, Flex and Flash

Adobe Flash (formerly Macromedia Flash) [Adobe2] is a multimedia platform used to add applications to present animation, video with interactivity into web pages. Flash applications are frequently used for advertisements and games.

Recently, it has been positioned as a tool for building Rich Internet Applications (RIAs). Flash applications manipulate vector and raster graphics to provide animation of text, drawings, and still images. They support bidirectional streaming for audio and video chat. Flash applications are developed in an object-oriented language - ActionScript. Flash content may be displayed on various computer systems and devices, using Adobe Flash Player, which is available free for common Web browsers and some mobile smart phones.

In order to build Adobe Flash applications, Adobe Flex [Adobe3], a part of Adobe Flash Platform is used. Adobe Flex is a software development kit released by Adobe Systems for the development and deployment of cross-platform rich Internet applications based on the Adobe Flash platform.

Flex applications can be written using a proprietary Integrated development environment (IDE), called Adobe Flash Builder, or by using the freely available Flex compiler from Adobe. In March 2010, Adobe released the Flex 4 SDK under the open source Mozilla Public License and so Flex applications can be developed using any standard IDE, for example Eclipse.

The scripting language that is used primarily for the development of websites and software using the Flash Platform is ActionScript [Adobe1].

ActionScript was initially designed for controlling simple 2D vector animations. Later versions added functionality allowing for the creation of Web-based games and rich Internet applications with streaming media (such as video and audio).

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Adobe announced in November 2011 that they would focus their work with Flash on PC browsing and mobile apps packaged with Adobe AIR, and would discontinue their development of the Flash Player for mobile browsers.⁹ As our mid-term aim is to enable the MWT on portable devices - tablets and, to some extent, smart phones - we have decided that after the so called Early Pilot phase (see Deliverable D11) - we would focus our development towards using HTML5 and JavaScript (see the next subsections).

4.3.1.2 JavaScript and Ajax

JavaScript [Hoeh06] is another scripting language that is widely used in Web applications. It has been developed by Netscape, and it has inherited Java's innovation, although, it is simpler. JavaScript is widely used for enhancing WWW pages with frames, forms and interactive content. Furthermore, it can be used to validate data before they are submitted to the server. JavaScript can be client or server side, but both share the same core language. The latest version of the language is JavaScript 1.8.1. "The advent of Ajax brought JavaScript to the spotlight and brought more professional programming attention", source: [Java10]. As it is mentioned in [Enter10] "the result was a proliferation of comprehensive frameworks and libraries, improved JavaScript programming practices, and increased usage of JavaScript outside of Web browsers, as seen by the proliferation of server-side JavaScript platforms".

Ajax (Asynchronous Javascript and XML) (van Kesteren, 2009) was brought to the spotlight and gained widespread usage since the advent of Ajax. Ajax is a group of interrelated Web development techniques used on the client-side to create interactive Web applications. "With Ajax, Web applications can retrieve data from the server asynchronously in the background without interfering with the display and behaviour of the existing page", source: (AP10). In (Ajax10) it is indicated that "the use of Ajax techniques has led to an increase in interactive or dynamic interfaces on webpages. Data is usually retrieved using the XMLHttpRequest object".

In 1998, Microsoft introduced Remote Scripting, a technology that allowed scripts running inside a browser, e.g., through a Java Applet, to exchange information with a server. Shortly after, in 1999, the XMLHttpRequest object was created as an ActiveX control in Internet Explorer 5. Other browsers (e.g., Mozilla, Safari) soon followed with their own implementation of this object. The XMLHttpRequest object can be accessed in JavaScript to transfer text in various formats, such as XML (for example SOAP messages), HTML, plain text, JavaScript Object Notation (JSON), and JavaScript, between the server and the browser synchronously at the background without the need of a page refresh.

Like DHTML and LAMP, Ajax is not a technology in itself, but a group of technologies. Ajax uses a combination of HTML and Cascading Style Sheets (CSS) to mark up and style information. The Document Object Model (DOM) is accessed with JavaScript to dynamically display, and to allow the user to interact with the information presented. "JavaScript and the XMLHttpRequest object provide a method for exchanging data

⁹ <http://blogs.adobe.com/conversations/2011/11/flash-focus.html>

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asynchronously between browser and server to avoid full page reloads”, source: (AP10). Specifically, the following technologies are required:

- HTML or XHTML and CSS for presentation,
- the DOM for dynamic display of and interaction with data,
- XML for the interchange of data, and XSLT for its manipulation,
- the XMLHttpRequest object for asynchronous communication,
- JavaScript to bring these technologies together.

Since then, however, there have been a number of developments in the technologies used in an Ajax application, and the definition of the term Ajax. In particular, it has been noted that JavaScript is not the only client-side scripting language that can be used for implementing an Ajax application. Other languages such as VBScript are also capable of the required functionality. However, JavaScript is the most popular language for Ajax programming due to its inclusion in and compatibility with the majority of modern Web browsers. Furthermore, XML is not required for data interchange and therefore XSLT is not required for the manipulation of data. JavaScript Object Notation (JSON) is often used as an alternative format for data interchange, although other formats such as preformatted HTML or plain text can also be used.

According to (Mesbah09), “Ajax potentially brings an end to the classical click-and-wait style of Web navigation, providing the responsiveness and interactivity end users expect from desktop applications...”. In a classical Web application, the user has to wait for the entire page to reload to see the response of the server. With Ajax, however, small delta messages are requested from the server, behind the scenes, by the Ajax engine and updated on the current page through modification to the corresponding DOM-tree.

This is in contrast to the classical multi-page style, in which after each state change a completely new DOM-tree is created from a full page reload.

Ajax gives a vehicle to build Web applications with a single-page Web interface, in which all interactions take place on one page. Single-page Web interfaces can improve complex, non-linear user workflows by decreasing the number of click trails and the time needed to perform a certain task, when compared to classical multi-page variants”.

4.3.1.3 HTML and CSS

Hypertext Markup Language (HTML) (Raggett, et al., 1999) is the most common language for publishing hypertext, platform independent documents in WWW. It supports text, multimedia and hypertext features, scripting languages, style sheets, printing facilities and documents. Its current stable version is 4.01, published on 24 December 1999 as a W3C recommendation. HTML (W3C, 2012) gives authors the means to:

- Publish online documents with headings, text, tables, lists, photos, etc.
- Retrieve online information via hypertext links, at the click of a button.
- Design forms for conducting transactions with remote services, for use in searching for information, ordering products, making reservations, etc.

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- Include spreadsheets, video clips, sound clips, and other applications directly in their documents.

HTML5 is currently under development as the next major revision of the HTML standard. Like its immediate predecessors, HTML 4.01 and XHTML1.1, HTML5 is a standard for structuring and presenting content on the WWW. The new standard incorporates features like video playback and drag-and-drop that have been previously dependent on third-party browser plug-ins such as Adobe Flash, Microsoft Silverlight, and Google Gears.

Cascading Style Sheets (CSS) (Bos, et al., 2011) is a language for calling fonts by name, controlling text size, specifying bolds and italics, and adding special effects. CSS allows the WWW author to control the layout, to make smaller, faster pages, and to easily maintain many pages at once. CSS gives lots of control over how characters, words, and lines can be spaced relative to one another. These CSS properties give power over the space between words and letters, the vertical spacing between lines of text, the alignment of text, margins and padding, borders, and floating elements.

The same source also mentions that Cascading Style Sheets, level 1 (CSS1) became a W3C Recommendation in December 1996. It describes the CSS language as well as a simple visual formatting model. CSS2, which became a W3C Recommendation in May 1998, builds on CSS1 and adds support for media specific style sheets (e.g. printers and aural devices), downloadable fonts, element positioning and tables. The CSS Mobile Profile specification became a W3C Candidate Recommendation in Oct 2001. CSS3 is currently under development.

4.3.1.4 Ajax Development frameworks

A definition of the Ajax Framework found in Wikipedia states "... a framework that helps to develop Web applications that use Ajax ...".

In fact, it is a collection of technologies used to build dynamic web pages on the client side. Data is read from the server or sent to the server by JavaScript requests.

However, some processing at the server side may be required to handle requests, such as finding and storing the data. This is accomplished more easily with the use of a framework dedicated to processing Ajax requests. The goal of the framework is to provide the Ajax engine and associated server and client-side functions.

Echo2 (<http://www.devx.com/Java/Article/41356/1954>) "is a pure Java framework for developing Ajax-based Web applications that can run in any servlet container. Developers using Echo2 typically do not need to know any HTML or JavaScript code, unless they are extending the framework. As a purely server-side product, Echo2 processes all client interactions on the server and sends results back to the browser in a DOM format. The Echo2 client engine then transforms the DOM into HTML. Since it is based on pure Java, Echo2 abstracts from the developer all the nuances of HTML, JavaScript, and traditional JSP-based application development. This allows Java programmers to build Web applications quickly and easily. Echo2 also instantly introduces Ajax capabilities into the application; the developer does not have to worry about the plumbing of the Ajax communication.

Along with these advantages, however, Echo2's server-side nature makes it slower than equivalent client-side frameworks. For this reason, many argue that Echo2 is better suited for intranet applications that do not require speed and bandwidth as much. Yet benchmark tests have shown that Echo2 performance is optimized to such a degree that it can serve all kinds of Web applications.”

The **Google Web Toolkit** (GWT, http://google.wikia.com/wiki/Google_Web_Toolkit) is an Ajax development tool from Google, targeted for Java developers. Web applications (both GUIs and RPCs) are written in Java using the GWT API. The Java files are then compiled into compact, obfuscated, browser-specific JavaScript files. A small bit of loading JavaScript determines which browser-specific script files get used depending on the user-agent. The API library is licensed under the Apache License 2.0. The GWT-Compiler was originally licensed under a proprietary license, but the most recent version is also licensed under the Apache 2.0 License. The Figure 3 depicts the remote procedure call used by GWT.

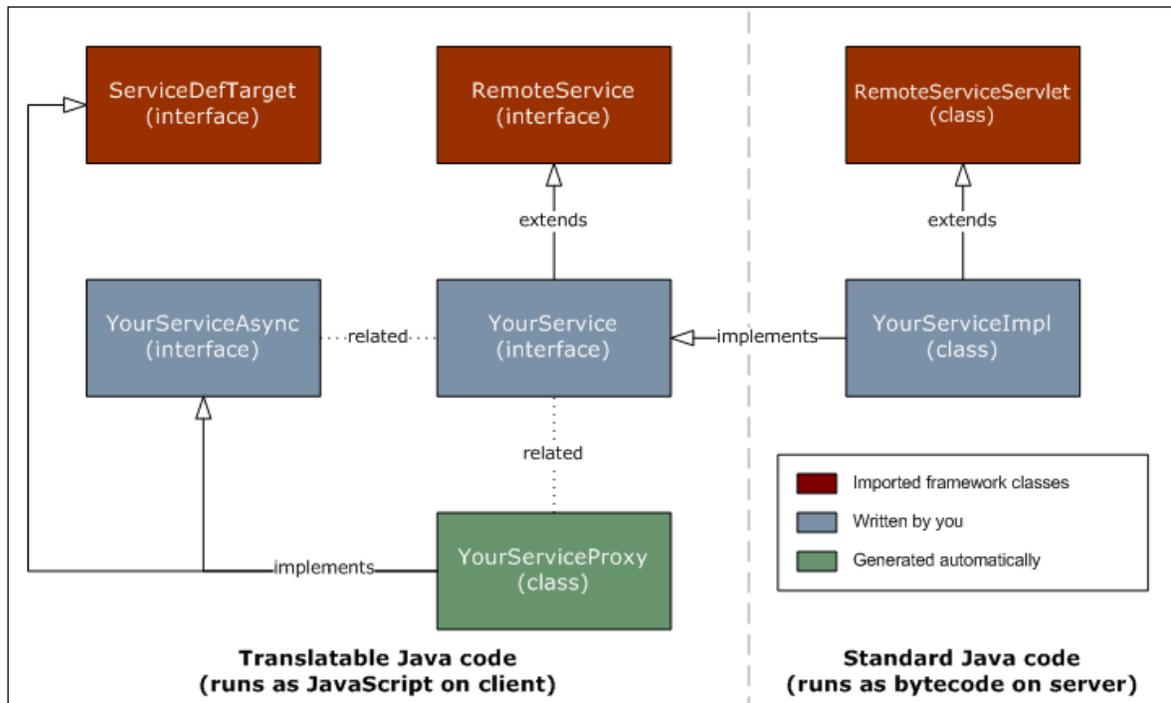


Figure 3 Remote Procedure Call by using Google Web Toolkit

For a more complete picture, other popular frameworks are listed in Table 3.

Table 3 Popular Ajax Frameworks

| Name | Technology | Description |
|----------|------------|---|
| AJAX.OOP | Javascript | An open source framework, providing an OOP-style coding engine and Ajax requests-handling functionality to create Web 2.0 components. |

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| Name | Technology | Description |
|----------------|------------|---|
| Ample SDK | Javascript | A standards-based Ajax framework, enabling Rich Internet application development. |
| Bindows | Javascript | An enterprise Ajax framework, with Windows look and feel. |
| Clean AJAX | Javascript | Framework also able to deal with Web services. |
| Qooxdoo | Javascript | It is a comprehensive Ajax application framework. Leveraging object oriented JavaScript allows developers to build impressive cross-browser applications. |
| SmartClient. | Javascript | It provides a zero-install DHTML/Ajax client engine, rich user interface components & services and client-server data binding systems. |
| Spry framework | Javascript | An open source Ajax framework developed by Adobe which is used in the construction of Rich Internet applications. |
| Apache Wicket | Java | An open-source Java server-centric framework supporting Ajax development. |
| AribaWeb | Java | An open-source framework with Reflection and Object-Relational mapping. |
| Backbase | Java | enterprise Ajax for Java Server Face (JSF). |
| DWR | Java | Direct Web Remoting. |
| Echo | Java | Ajax Servlets. |
| Vaadin | Java | A server-side Java widget framework utilizing GWT. |
| ItsNat | Java | A server-side Java framework focused on single-page interface Applications. |
| OpenXava | Java | A model-driven framework for creating Ajax business applications. |
| RAP | Java | The Eclipse Rich Ajax Platform |
| Tersus | Java | An open-source platform for developing rich Web applications by visual Programming. |
| Wt | C++ | A C++ Web Toolkit. |
| ASP.NET AJAX | .NET | |
| Quicknet | PHP | An Ajax framework that provides secure data transmission, uses PHP on the server side. |
| Sajax | PHP | A PHP framework with a lot of functions, easy to integrate functions Yourself |
| Xajax | PHP | It uses only the XML format, on the server side |
| Pyjamas | Python | A widget library with a Python to JavaScript compiler. |

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4.3.2 Web 2.0 Protocols

We have seen that protocols in Web 2.0 applications, based on HTML5 and JavaScript, are mostly asynchronous protocols as in AJAX. There are various protocols implemented in the AJAX frameworks and they are all based on RPC; here we will describe them succinctly.

4.3.2.1 Protocols for RPC

A Remote Procedure Call (RPC) is an inter-process communication that is widely used in Web 2.0 applications. It allows a computer program to cause a subroutine or procedure to execute in another address space (commonly on another computer on a shared network) without the programmer explicitly coding the details for this remote interaction. That is, the Web programmer writes essentially the same code whether the subroutine is local to the executing program, or remote. When the software in question uses object-oriented principles, RPC is called remote invocation or remote method invocation.

Simple Object Access Protocol (SOAP) is a lightweight protocol for the exchange of information in a decentralized, distributed environment. "It is a way for a program running in one kind of operating system to communicate with a program in the same or another kind of operating system by using the WWW's Hypertext Transfer Protocol (HTTP) and the Extensible Markup Language (XML) as the mechanisms for information exchange." Since Web protocols are installed and available for use by all major operating system platforms, HTTP and XML provide an already at-hand solution to the problem of how programs running under different operating systems in a network can communicate with each other. SOAP specifies exactly how to encode an HTTP header and an XML file so that a program in one computer can call a program in another computer and pass it information. It also specifies how the called program can return a response. SOAP Version 1.2 is the latest version of this protocol released in April 2007.

XML-RPC is a flavor of an RPC protocol that uses XML to encode its calls and HTTP as a transport mechanism. It works by sending an HTTP request to a server implementing the protocol. The client in that case is typically software wanting to call a single method of a remote system. Multiple input parameters can be passed to the remote method, and one return value is returned. The parameter types allow nesting of parameters into maps and lists, thus larger structures can be transported. Therefore XML-RPC can be used to transport objects or structures both as input and as output parameters. Identification of clients for authorization purposes can be achieved using popular HTTP security methods. Basic access authentication is used for identification; HTTPS is used when identification (via certificates) and encrypted messages are needed. Both methods can be combined.

JSON-RPC is similar to XML-RPC.

4.3.3 Web 2.0 Security for Distributed Applications

The M3W project aims at measuring the mental health status of its users therefore security and privacy are especially important topics. We need to provide a secure environment and to build confidence with our primary users. Therefore Internet security

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is an important topic that we should address. In order to build confidence, the M3W system should be as no disruptive as possible. This also means that the M3W system shall only be available within and for existing user communities.

In the context of distributed applications such as Web 2.0 applications different considerations must be taken into account when we implement security and trust. One of the most important and complex issues is authentication. Password authentication is relatively simple but vulnerable. However, in case of our major target group, consisting mostly of computer-illiterate elders, other, more secure and sophisticated authentication mechanisms cannot be applied. Even password authentication can be too difficult for many of our potential players, especially when they have to remember and apply many passwords with different applications. Fortunately, this important topic has been recently tackled by the Internet Community, and the joint efforts have resulted in a new kind of authentication systems, the so called Identity Management Systems (IdMS). When an IdMS is applied, users may identify themselves with their identity "borrowed" from their Google Mail or Facebook or similar OpenID accounts.

In consequence, the M3W system will not implement its own authentication solution but will rely on the authentication mechanism of the Drupal Content Management System which allows several authentication methods, including its own solution and a number of OpenID providers such as Google, Facebook and MyOpenId.

4.3.3.1 Identity Management Systems

Identity Management Systems (IdMs), allows a Service Provider (SP) to offer a service without implementing its own authentication system, and to trust in its stead another entity—an Identity Provider (IdP)—to provide authenticated users to them.

Within distributed systems such as the internet different considerations must be taken into account when designing identity management systems (IdMs) then when designing that for closed systems. The inherent openness of the internet and the fact that the internet was defined with no way to determine who or what a client is connecting to, coupled with the increased criminalisation of the internet through attacks such as Phishing and Pharming have lead to a proliferation of different security standards and technologies. In this subsection, we are attempting to both document and analyse the current state of the art of identity management solutions.

Enabling local attribute based authorisation using attributes issued by a remote attribute authority is possible today with some IdM systems such as Shibboleth and CardSpace. However, a problem arises if a Service Provider (SP) wishes to use attributes issued by multiple Attribute Authorities (AAs) to grant access to its resources, as most of these systems have been designed to use a single Identity Provider for attribute release. Researchers and early adopters are realizing that a single source of user attributes is insufficient for authorization in many applications, e.g. access to a medical database may require a GP attribute from the General Medical Council and a consultant attribute from the employing hospital be present in order to grant access to patient records. Since the same user will generally be known by different identifiers in each IdP/AA, this makes the collection and aggregation of attributes from different IdPs difficult; source (TAS3, 2009).

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The concept of a **digital identity** can be reasonably stated as a set of data that can be used to uniquely represent a single person or organisation within a specific domain. A single identity can be seen to be made up of a collection of all the electronic information (or identifiers) associated with an individual's account in a particular identity system. The identity itself does not have to refer to a single individual but rather a single entity which could consist of multiple user's but as far as the service provider is concerned, it will always be dealing with a single real world entity, e.g. any employee within a company may be able to use a single company identity to access an offsite resource. It must also be seen that in most cases it is possible for any entity to possess several different but equally valid identities within a single identity management domain, e.g. a user may possess both an account that s/he uses to identify her/himself in a professional capacity when s/he is at work representing her/his employer and a separate account that s/he uses in a personal capacity.

In order to interact with an IdM system a user must be assigned an identifier that uniquely identifies a user account within that particular domain in order to prevent confusion of users within that domain. This identifier can then be linked with additional identifiers (or attributes) in order to create the whole digital identity. Authentication can take place using any user identifier that uniquely identifies the principal whereas any additional identifiers/attributes can be used for authorization.

Whilst there have been many definitions of **trust**, the following definition found in (TAS3, 2009) is that "trust is the extent to which one party is willing to depend on something or somebody in a given situation with a feeling of relative security, even though negative consequences are possible". This definition includes the basic ingredients of trust; dependence on the trusted party, the reliability of the trusted party and the risk inherent in using the trusted party. The definition also infers that trust requirements are directly correlated to risk exposure and therefore the level of trust required to access a service can be seen to represent a level of risk that the user should be able to determine and act accordingly.

Trust deals with assumptions, expectations and behavior. This clearly implies that trust cannot be measured quantitatively, that there is a risk associated with trust and that the establishment of trust cannot always be fully automated. However, the concept of a trust model is useful as it shows where and how trust is initiated, which can allow more detailed reasoning about the security of the underlying architecture as well as any limitations imposed by the architecture. A set of requirements below summaries the necessary pre-existing trust relations involved between entities:

A client has trust in a service provider (SP) if:

- a) The SP protects the client's privacy;
- b) The SP has implemented satisfactory user registration procedures and authentication mechanisms (from the client's perspective);
- c) The SPs adhere to the accepted policy for correlating personal data about the same client from other SPs.

A service provider has trust in a client if the client handles their authentication credentials with appropriate care.

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Trust between Federated Service Providers exists if a service access by assertions between service providers on behalf of users will only take place when legitimately requested by the client.

Trust In the Identity Mapping exists if the mapping of identities between service providers is correct.

A Service Provider trusts in a Credentials Provider if the credentials provider has implemented adequate procedures for registering users and for issuing credentials.

4.3.3.2 Federated Identity Management Architectures

Shibboleth 2.0 is based on the open source OpenSAML 2.0 library and adds support for SAML 2.0 Authentication, Single Logout, and Artifact resolution request/response pairs.

- Shibboleth 2.0 interoperates with its predecessor, Shibboleth 1.3.
- Certificates need to be embedded in the metadata to take advantage of many SAML 2.0 features.
- SAML 2.0 Single Logout is implemented with both front-channel browser and back-channel SOAP calls. Applications that maintain session information need modification to handle logout requests.
- SAML 2.0 Authentication includes some basic support for the 'AuthnContext' concept, an XML schema to express both technical and procedural aspects of user authentication and identity proofing.

Windows CardSpace, formerly known by its codename InfoCard, is a framework developed by Microsoft that securely stores digital identities of a person, and provides a unified interface for choosing the identity for a particular transaction, such as logging in to a website. Windows CardSpace is a central part of Microsoft's effort to create an Identity Metasystem, or a unified, secure and interoperable identity layer for the Internet. When a CardSpace-enabled application or website wishes to obtain personal information about the user, the application or site demands a particular set of claims or a particular token type from the user. CardSpace then appears, taking over the display of the computer and represents the stored identities as virtual information cards. The user selects the card to use and the CardSpace software contacts the issuer of the identity to obtain a digitally signed XML token that contains the requested information. CardSpace allows users to create self-issued identities for themselves, which can contain one or more of around 15 fields of telephone-book quality identity information. Other transactions may require a managed identity issued by a trusted identity provider, such as a bank, employer or a governmental agency. Windows CardSpace is built on top of Web Services Protocol Stack discussed in the previous chapter.

This means that any technology or platform that supports WS-* protocols can integrate with CardSpace. In order to accept information cards, a website developer simply needs to declare an HTML <OBJECT> tag that specifies the claims the website is demanding from the user and then implement code to decrypt the returned token and extract the claim values. If an Identity Provider wants to issue tokens, they must provide a means by which a user can obtain a managed card and provide a Security Token Service

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(STS) that handles WS-Trust requests and returns an appropriate encrypted & signed token. If an IdP does not wish to build an STS, they will be able to obtain one from a variety of vendors including PingID, BMC, Sun or Microsoft, as well as other companies or organisations.

Because it is token-agnostic, CardSpace does not compete directly with other Internet identity architectures like OpenID and Liberty Alliance. In some ways the three approaches to identity can be seen as complementary.

In February 2006, IBM and Novell announced that they will support the Higgins trust framework to provide a development framework that subsumes support for the Web Services Protocol Stack underlying CardSpace within a broader, extensible support for various other identity-related technologies, such as SAML and OpenID. (Note that initial reports in the mainstream media positioning Higgins as a direct competitor for InfoCard were somewhat misconstrued.)

Microsoft included Windows CardSpace in Windows Vista. CardSpace is also available as part of Microsoft's .NET Framework 3.0 for Windows XP and Windows Server 2003.

Liberty Alliance Identity Federation Framework is a standardized approach that defines processes and procedures for Content Service Providers (CSPs), relying parties, and operators of federated identity networks (Federation Operators) to trust each other's credentials at known levels of assurance. The main components of the Identity Assurance Framework (IAF) are:

- 1 **Assurance Level Criteria.** Assurance levels are the levels of trust associated with a credential as measured by the associated technology, processes, and policy and practice statements.
- 2 **Service and Credential Assessment Criteria.** The Service and Credential Assessment Criteria section in the IAF establishes baseline criteria for organizational conformity, identity-proofing services, credential strength, and credential management services against which all CSPs will be evaluated.
- 3 **Accreditation and Certification Model.** The IAF uses a phased approach to establish criteria for certification and accreditation, initially focusing on CSPs and the accreditation of those who will assess and evaluate them.
- 4 **Associated Business Rules.** The Business Rules section of the IAF identifies: how CSPs and relying parties can participate in or be bound by the rules; what the roles and obligations are of the various parties to the rules, i.e., the IAEG, CSPs, relying parties, and assessors; the means of enforcement of and recourse under the rules; and, the general terms of the rules (including Governing Law, severability etc.).

The Liberty Alliance framework consists of two major components; the Identity Federation Framework (ID-FF) [182] and the Identity Web Services Framework (ID-WSF) [183]. These frameworks are based upon the SAML standards discussed in the standards section.

WS-Security, Trust and Federation, describes enhancements to SOAP messaging to provide quality of protection through message integrity, message confidentiality, and

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single message authentication. These mechanisms can be used to accommodate a wide variety of security models and encryption technologies.

WS-Security also provides a general-purpose mechanism for associating security tokens with messages. No specific type of security token is required by WS-Security. It is designed to be extensible (e.g. support multiple security token formats). For example, a client might provide a proof of identity and a proof that they have a particular business certification.

Additionally, WS-Security describes how to encode binary security tokens. Specifically, the specification describes how to encode X.509 certificates and Kerberos tickets as well as how to include opaque encrypted keys. It also includes extensibility mechanisms that can be used to further describe the characteristics of the credentials that are included with a message.

By using the SOAP extensibility model, SOAP-based specifications are designed to be composed with each other to provide a rich messaging environment. By itself, WS-Security does not ensure security nor does it provide a complete security solution. WS-Security is a building block that is used in conjunction with other Web service and application-specific protocols to accommodate a wide variety of security models and encryption technologies. Implementing WS-Security alone does not mean that an application cannot be attacked or that the security cannot be compromised.

Ws-Trust [187] builds upon the WS-Security framework by defining mechanisms for brokering trust relationships, requesting and returning security tokens.

WS-Federation [188] is a specification that builds on WS-Security and WS-Trust to support federation of identity across trust domains, and to support mapping identities in support of single sign-on and sign-off. WS-Federation solves a similar problem to the Liberty Alliance IDWSF framework, but is composable with other WS* protocols.

4.3.3.3 TAS³ Integrated Project (FP7-ICT_2007)

The TAS³ Integrated Project (Trusted Architecture for Securely Shared Services) aimed to have a European-wide impact on services based upon personal information, which is typically generated over a human lifetime and therefore is collected & stored at distributed locations and used in a multitude of business processes. The architecture proposed by the TAS³ project can be instantiated in different contexts because the nature of this personal information is not specific to TAS³. The TAS³ project has validated & demonstrated its applicability in the domains of e-Employability and e-Health.

The TAS³ project developed a trusted architecture and set of adaptive security services which preserve personal privacy and confidentiality in dynamic environments. Specifically, TAS³ provides a trust & security architecture that is ready to (1) meet the requirements of complex and highly versatile business processes, (2) enable the dynamic user-centric management of policies and (3) ensure end-to-end secure transmission of personal information and user-controlled attributes between heterogeneous, context dependent and continuously changing systems. This architecture has been designed to fulfill the above objectives through a combination of:

- providing users with the ability to meaningfully give their consent to the use of their personal information;
- ensuring a complete set of audit information is recorded by a TAS3 trust network and that users have the ability to directly or indirectly see the audit information that pertains to their personal information;
- a legal framework and set of model contracts that will contractually bind all service providers into operating in a trustworthy manner;
- a set of trusted third parties that facilitate the sharing of trust related information such as public keys, authorization attributes, and reputation information.

This includes a trust and data protection infrastructure for managing & assessing the risks associated with identity authentication (level of assurance) and the trustworthiness of actors.

Because of the strategic nature of the relationship between contractual framework and the technology, policies and processes, it is important to understand the capacity of technology to either enforce some of the contractual processes or otherwise support it. The other side of that concept is the importance of knowing the limitations of technology in terms of feasibility, capacity and technology and to know what functions are best allocated to contracts or policies.

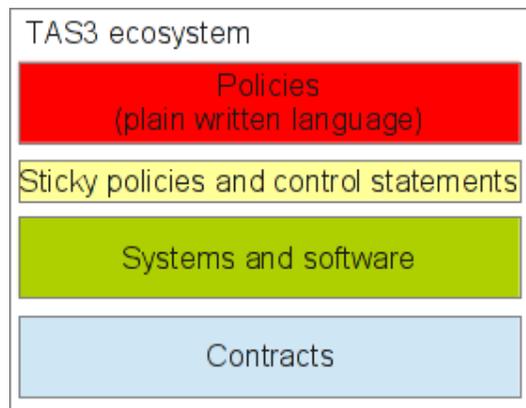


Figure 4 The TAS³ architecture

Figure 4 depicts the TAS³ architecture consisting of the 4 main elements of the Trust Network, which comprise the governance architecture. Each of these elements has distinct functions but needs to interrelate with the other three to form a whole.

Within the realm of the TAS³ project, the group has made four software packages publicly available, each of which implement one or more TAS³ components. The currently available software packages are:

A standalone authorization server package which provides access control and credential validation functionality. This software package also provides limited Master PDP functionality as it is possible to configure the authorization web service with three different policy types: PERMIS policies, XACML policies and Trust Policies.

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The Secure Audit Trail for Web Services (SAWS) package which provides the functionality to create a secure audit trail of messages sent to it. The package also supports off-line searching of the audit trail.

The Delegation Issuing Service (DIS) which empowers end users to dynamically delegate some of their attributes (privileges) to others in accordance with a delegation policy.

The PERMIS Policy Editor (PE) which provides users with the ability to write PERMIS authorisation and delegation policies while being shielded from the underlying XML policy language. This software package has three modes of operation: one can use the Policy Wizard, the Controlled Natural Language Processing (CNLP) interface or the main GUI itself.

4.3.3.4 OpenID

OpenID is different from the other identity frameworks discussed above, in the sense that it does not attempt to establish a trust metric. Instead, OpenID is user-centric and allows the user to establish an identity from an owned URL (for example a personal blog). A user will map their identity (the URL) to an Identity Provider of her/his choice, by adding a username and a reference to the IdP in the HTML meta-element on her/his webpage.

OpenID focuses on the consumer market, whereas FID-proper is focused on the enterprise—but the concept is the same. It offers the ability for users to log into one website (Facebook, for example) using credentials from another website, such as Google (who is now an OpenID identity provider).

The general OpenID scenario is as follows:

1. The end-user gives to the website, he/she wants to use, his/her OpenID.
2. The website goes to that location to see where the end-user need to authenticate.
3. The website redirects him/her to that location (his/her OpenID provider).
4. The end-user authenticates himself to his/her OpenID provider.
5. His/her OpenID Provider tells the website, he/she wants to use, that he/she is a valid person (but without giving it his/her password).
6. The end-user is now able to use the website without having to give it any password.

Here are a few of the main benefits of OpenID:

1. It reduces the number of usernames and passwords you need to remember.
2. It leverages information in your OpenID profile while signing up on new website.
3. You don't have to worry about your password being compromised at a given website, OpenID-based sites don't actually store your OpenID password at all.

Differently from a SAML SP, an OpenID consumer will not trust the IdP directly; neither will an OpenID consumer try to map the resolved identity to a real-life person. Instead, OpenID attempts to be a tool for the user to prove that he/she is the same person that created an account at a service provider (user profile). The service provider will benefit from a simpler registration mechanism and does not need to implement password storage and retrieval. Registration and login will also be simpler for the user, and the user will benefit from SSO functionality, by remembering only one username and password.

4.3.3.5 OAuth 1.0 and 2.0

OAuth 1.0 is complementary to OpenID. OpenID is about identification and authentication, whereby OAuth is about authorization.

The sharing scenario comes up when an end-user, within two different social networking services, wants to leverage each other services. For example the end user wants his social site like Facebook access to his/her picture sharing website like Flickr without storing his/her Flickr credentials into his/her Facebook profile.

The diagram in Figure 5 below shows Google’s description of the OpenID process, including the sending and receiving of OAuth tokens. The key is that the OAuth piece is optional since it has a separate authorization component added on top of the OpenID authentication protocol.

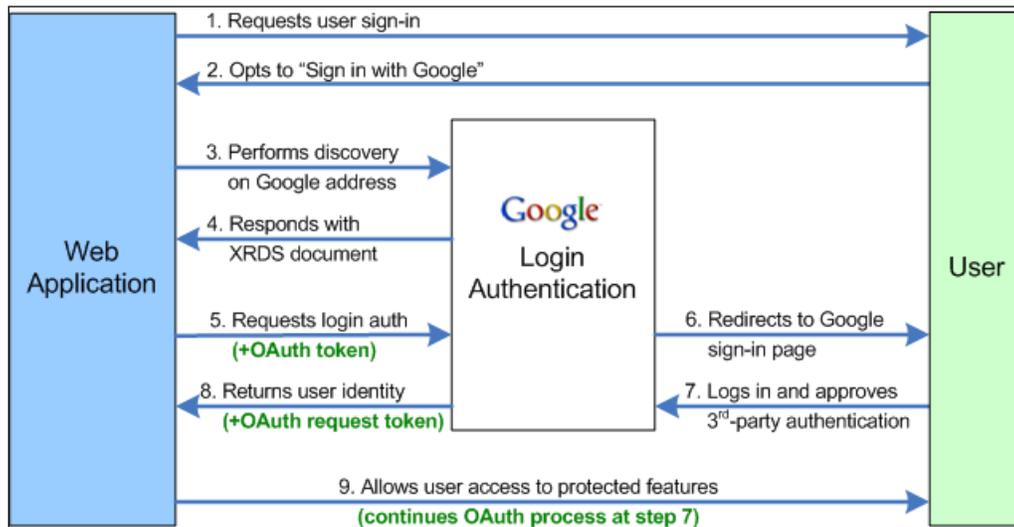


Figure 5 OpenID authentication protocol.

OAuth 2.0 is a completely new protocol and is not backwards compatible with previous versions. However, it retains the overall architecture and approach established by the previous versions.

The following is a subset of the new features available in OAuth 2.0.

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New Flows; OAuth includes two main parts: obtaining a token by asking the user to grant access, and using tokens to access protected resources. The methods for obtaining an access token are called flows. OAuth 1.0 started out with 3 flows and OAuth 2.0 with 6 different flows - User-Agent Flow, Web Server Flow, Device Flow, Username and Password Flow, Client Credentials Flow and Assertion Flow. Here we describe the Assertion Flow as it offers the best trade-off for the M3W scenario. In the Assertion Flow, the client presents an assertion such as a SAML assertion to the authorization server in exchange for an access token.

Bearer tokens; OAuth 2.0 provides a cryptography-free option for authentication which is based on existing cookie authentication architecture. Instead of sending signed requests using HMAC and token secrets, the token itself is used as a secret sent over HTTPS. This allows making API calls using cURL and other simple scripting tools without having to canonicalize the request and sign it.

Simplified signatures; Signature support has been significantly simplified to remove the need for special parsing, encoding, and sorting of parameters. It also uses a single secret instead of two.

Short-lived tokens with Long-lived authorizations; Instead of issuing a long lasting token (typically good for a year or unlimited lifetime), the server issues a short-lived access token and a long lived refresh token. This allows clients to obtain a new access token without having to involve the user again, but keeps access tokens limited. This feature was adopted from Yahoo!'s BBAuth protocol and later its OAuth 1.0 Session Extension.

Separation of Roles; OAuth 2.0 separates the role of the authorization server responsible for obtaining user authorization and issuing tokens from that of the resource server handling API calls.

Specification Readiness; OAuth 2.0 has been developed by the IETF OAuth Working Group. Support is available from Facebook, Google Microsoft and Twitter. The final specification was published by the end of 2012.

4.3.3.6 Standards

SAML 1.1 is an OASIS standard approved in August 2003. The approved specification set consists of:

- a) **Assertions and Protocol:** The specification defines the syntax and semantics for XML-encoded Security Assertion Markup Language (SAML) assertions, protocol requests, and protocol responses. These constructs are typically embedded in other structures for transport, such as HTTP form POSTs and XML-encoded SOAP messages.
- b) **Bindings and Profiles:** The document specifies protocol bindings and profiles for the use of SAML assertions and request-response messages in communications protocols and frameworks.
- c) **Conformance Program Specification:** This document describes the program and technical requirements for the SAML conformance system.

The Security Assertion Markup Language (SAML) is an XML-based framework for exchanging security information. This security information is expressed in the form of assertions about subjects, where a subject is an entity (either human or computer) that has an identity in some security domain. A typical example of a subject is a person, identified by his or her email address in a particular Internet DNS domain.

Assertions can convey information about authentication acts that were previously performed by subjects, attributes of subjects, and authorization decisions about whether subjects are allowed to access certain resources. A single assertion might contain several different internal statements about authentication, authorization, and attributes.

Assertions are issued by SAML authorities, namely, authentication authorities, attribute authorities, and policy decision points. SAML defines a protocol by which clients can request assertions from SAML authorities and get a response from them. This protocol, consisting of XML-based request and response message formats, can be bound to many different underlying communications and transport protocols; SAML currently defines one binding, to SOAP over HTTP.

SAML authorities can use various sources of information, such as external policy stores and assertions that were received as input in requests, in creating their responses. Thus, while clients always consume assertions, SAML authorities can be both producers and consumers of assertions.

The following model in Figure 6 is conceptual only; for example, it does not account for real-world information flow or the possibility of combining of authorities into a single system.

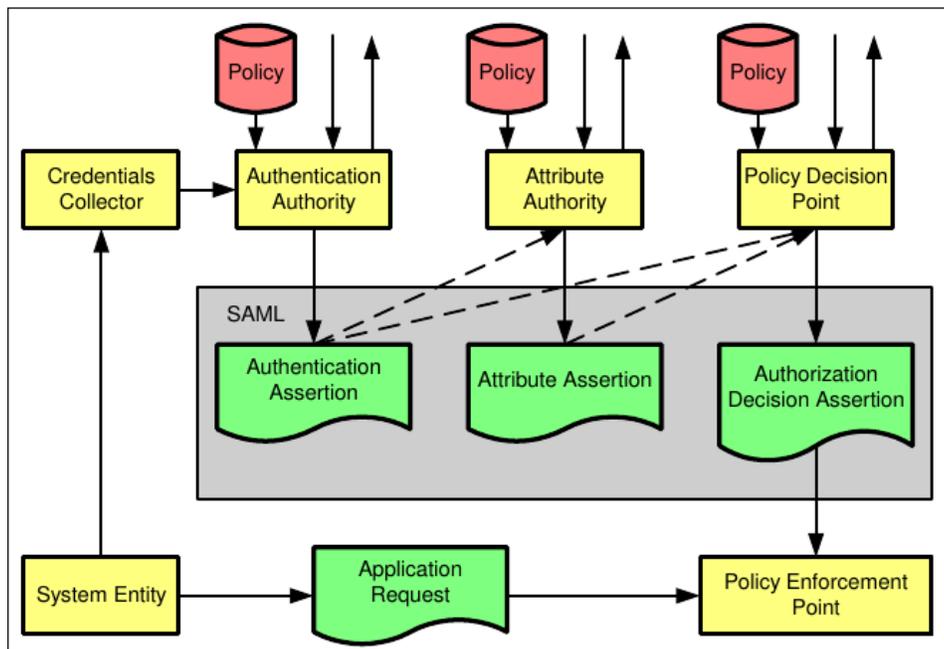


Figure 6 SAML Domain Model

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SAML V2.0 enhancements include features derived from the Liberty Alliance Identity Federation Framework (ID-FF) V1.2 specifications that were contributed to the OASIS Security Services Technical Committee in 2003, capabilities present in the Internet2's Shibboleth architecture, and enhancement requests resulting from experience with numerous deployments of SAML V1.x in the industry.

The on-the-wire representations of SAML V2.0 assertions and protocol messages are incompatible with SAML V1.x processors. As is explained in the SAML Assertions and Protocols specification, only new major versions of SAML typically cause this sort of incompatibility. In the 2.0 release, much of the incompatibility is syntactic in nature; this was done for consistency and better component symmetry.

4.3.3.7 Current SAML 2.0 Deployments

OpenSAML is an open-source toolkit, in Java and C++, produced by Internet2 developers as part of their work on the Shibboleth project. It is able to create objects with the individual information fields that make up a SAML message, build the correct SAML representation, and parse the SAML back into object form, as well as supporting developers implementing application using various SAML profiles and transport bindings. OpenSAML 2, which is a deployment for the last version of the SAML protocol, is a complete rewrite of OpenSAML 1 built upon a generic library (XMLTooling) for working with XML as objects. OpenSAML is written by the developers of, and is part of, the Shibboleth development effort. Therefore OpenSAML 2 is tied to the release of Shibboleth 2.0.

OpenSSO, The Open Web Single Sign-On Project is an open development effort based on the source code for Sun Java™ System Access Manager, a core identity infrastructure product offered by Oracle Corp. (originally developed by Sun Microsystems, Inc., acquired by Oracle in 2010). The goal of OpenSSO is to provide an extensible foundation for an identity services infrastructure that will facilitate single sign-on (SSO) for web applications hosted on web and application servers in the public domain. Sun Java System Access Manager and Sun Java System Federation Manager are two products designed to support secure and standards-based federation solutions and access to resources. Both of them implement SAML 2.0 among other standards. The next versions of these products will be built from the OpenSSO source. As part of the OpenSSO project, Sun has developed Open Federation, which is an open source project based on the identity federation and web services framework developed for Sun Java System Access Manager and Sun Java System Federation Manager. Open Federation provides an extensible framework to support these features.

Another part of OpenSSO is a SAML 2.0 Service Provider (SP) implementation in PHP called the Lightbulb. Its goal is to provide a lightweight means of federating identities, implemented in a scripting language, which will allow users to sign in with a single authentication key and move seamlessly between a variety of interlinked and recombined web services projects. Currently the Lightbulb project is only available for PHP, but it is expected that implementations with Ruby and other scripting languages will also be available.

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Lasso is a free software C library developed by the French company Entr'ouvert, aiming to implement the Liberty Alliance standards. It defines processes for federated identities, single sign-on and related protocols and is licensed under the GNU General Public License.

The **ZXID project** aims at providing a full stack implementation of all federated identity management and identity web services protocols. Its initial goal is supporting the SP role, followed by ID-WSF WSC and IdP roles. ZXID currently includes a C program that implements a SAML 2.0 Service Provider as a CGI script (zxid), a C library for supporting SAML 2.0, including federated SSO (libzxid), as well as a Perl module, a PHP extension and a Java JNI extension that wrap libzxid. ZXID is free software (under the Apache License 2.0) and is developed by Sampo Kellomäki, co-founder of Symlabs, and initiator of the EU project TAS3.

Symlabs Federated Identity Access Manager is a free product created by Symlabs provides a multi-protocol federated identity solution encompassing ID-FF 1.2, ID-WSF 1.1, and WS-Federation in Identity Provider, Service Provider, and Enhanced Client roles. Symlabs complements this solution for Identity Management front end with its Directory Extender 3.0 product which addresses ID firewall and back end requirements. Symlabs Federated Identity Access Manager was certified for SAML 2.0 conformance for all available profiles.

4.3.3.8 Summary

Federated Identity is where one entity trusts another entity with user management. SAML, IAF and WS-Security are complementary underlying technologies to implement authorisation and authentication for web services. OpenID is one type of Federated Identity, where major websites are now allowing you to log into them using OpenID credentials rather than individual usernames and passwords for each specific site. OAuth allows you to share information and content between sites without sharing your password and limiting what can be accessed from one to another.

4.3.4 Web 2.0 Community Building Tools

In the context of M3W, the participation in community activities mean to integrate the applications environment into one common environment, incorporating Web applications and internet services in one experience where all services will be available through the M3W Server and the game environment. In the following sections we shall discuss the existing ways how users can participate and collaborate within their communities.

4.3.4.1 Instant messaging

Instant messaging software is mainly based on Ajax technology. A typical Ajax chat application uses a database (MySQL) and Ajax to store and retrieve the users' messages and pass them between the client and the server. The chat window contacts the server periodically to send and retrieve the newest posted messages from the server to each user. In the rest of the subsection, we present some typical instant messaging software examples.

AJAX Chat Platform (<http://blueimp.net/ajax>)

According to the description found in their website “AJAX Chat is a free and fully customizable open source Web chat software implemented in JavaScript, PHP and MySQL (Figure 7). Ajax chat also supports voice chat using Flash, Socket support using Flash on client-side and Ruby on server side”. Both “text chatting” and “voice chatting” use the client-server model. This means that in order for two clients to communicate with each, other intermediate servers are used (Jabber servers [Basc06]), as opposed to the P2P model where the intermediate server is used only for introducing peers.

AJAX Chat can easily be integrated with phpbb, MyBB, PunBB, SMF, vBulletin and other PHP community software.

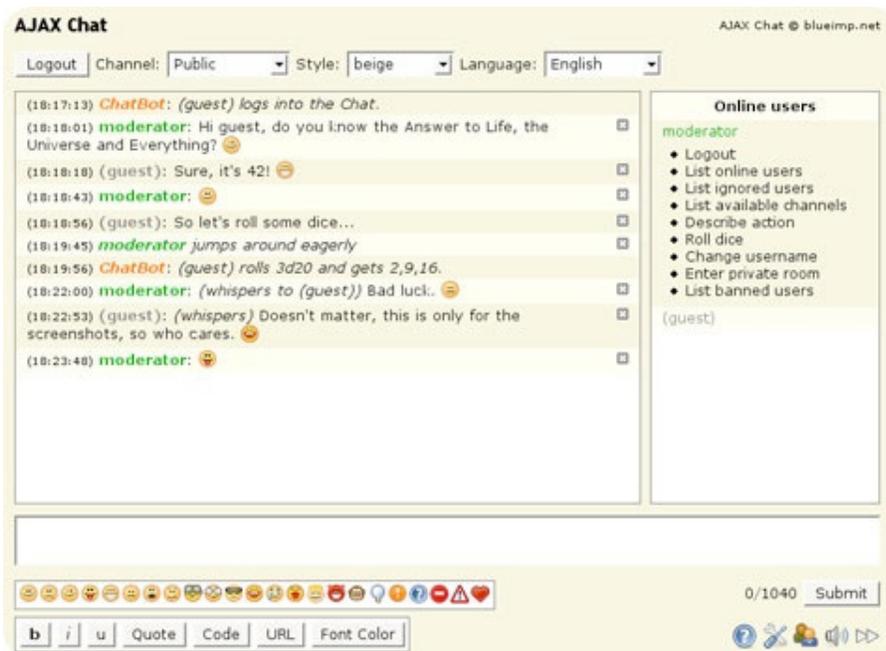


Figure 7 Ajax-based chat platform.

Google Hangouts (previously: Talk; <http://www.gmail.com>)

As it is described in their website, “on February 7, 2005, Gmail received chat functionality, using Ajax for server–browser communication, and was integrated with Google Talk. Users can send instant messages to other Gmail users. As it works within a browser, Google Talk does not need to be downloaded to send instant messages to Gmail users”. Gmail chat also supports audio and video chatting. For that, the users have to download a Gmail voice and video chat plug-in. The chatting is peer to peer, in the sense that the data exchanged by the users during the chat session do not need to pass through a chat server. The new Hangouts that has replaced Talk in early 2013 “brings one-on-one and group conversations to life with photos, emoji [pictograms like ideograms and smileys], and video calls for free. It connects friends across computers, Android and Apple devices.”

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ChatZilla (<https://addons.mozilla.org/el/firefox/addon/16>)

“ChatZilla is a clean, easy to use and highly extensible IRC client, built on the Mozilla platform. It is written entirely in JavaScript, supported by XUL, CSS and HTML. It is designed to run on any platform on which Mozilla runs, such as Mac OS, Linux, BSD, Microsoft Windows, Solaris, IRIX, BeOS, AIX, HP-UX, and OS/2. It currently supports most standard features of IRC clients, including connections to multiple servers, a built-in list of standard networks, easy searching and sorting of available channels, logging, Direct Client-to-Client (DCC) chat and file transfers, plus easy customization with scripts and styles. DCC is an IRC-related sub-protocol enabling peers to interconnect using an IRC server for handshaking in order to exchange files or perform nonrelayed chats. Once established, a typical DCC session runs independently from the IRC server. It also supports IPv6, SSL, and UTF-8. By default, JavaScript is used as the scripting language. Messages are styled using CSS, which means that the style of the client can be easily changed, including one that places photographs next to the names of users who speak in the channel”, DCC, which allows users to transfer files and chat directly between one another, is supported but with no resume for file transfers.

ChatZilla is currently included with SeaMonkey as well as being available for Mozilla Firefox as an optional extension.

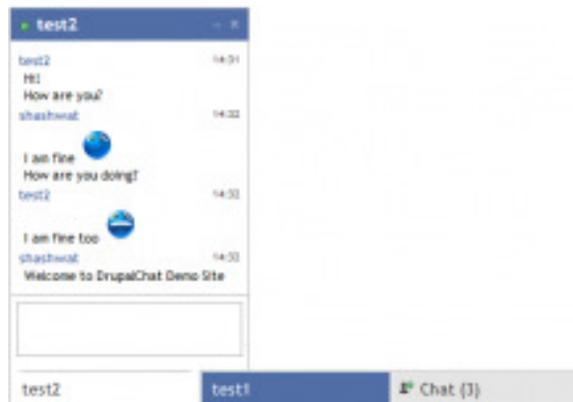
Mibbit (<http://www.mibbit.com>)

Mibbit is described as “a Web-based client for modern Web browsers that supports IRC, Yahoo Messenger, and Twitter. Unlike typical Web-based IRC clients, like ChatZilla, Mibbit makes use of a client–server design model. The user interface is written in HTML and JavaScript using Ajax programming techniques. The client's backend is written completely in Java, and operates independently of the Web server in a standalone fashion on the Mibbit server. This design differs from Web browser component clients or Java applet based IRC clients such as PJIRC and ChatZilla that operate entirely from within the Web browser. It also differs from Web 3.0: the semantic Web server-based Web proxy IRC clients such as CGI:IRC where all processing takes place on a remote server”.

Drupal Chat (<https://drupal.org/project/drupalchat>)

DrupalChat allows visitors of your Drupal site to chat with each other privately or together in a public chatroom. This module enables sites to provide online support for their products/services, and thereby increases user engagement. Also, it is useful for social networking sites, forums, blogs, etc. It logs the user conversations so that they can be later viewed in message inbox. It will utilize the resources of the same server on which the Drupal site is hosted and use AJAX or long polling method for updating chat messages.

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Pidgin (<http://www.pidgin.im>)

Pidgin is a chat program which lets you log in to accounts on multiple chat networks simultaneously. This means that you can be chatting with friends on MSN, talking to a friend on Google Talk, and sitting in a Yahoo chat room all at the same time.

Pidgin runs on Windows, Linux, and other UNIX operating systems. For OS X it's named Adium.

Jappix Mini (<https://jappix.com/?l=en>)

Jappix is an open social platform that lets you easily get or keep in touch with everyone. Jappix Mini is a mini-chat available for your website.

It is really simple to setup and to use. Besides, it was designed to be easy to integrate to every website system and CMS. It uses the XMPP protocol, so that you can login to a XMPP account, or use it to join a groupchat.

Java/JavaScript chat (<http://www.php-development.ru/software/chat-java.php>)

“Java/JavaScript Chat is a chat software that allows the users of a website or a private network to communicate with each other”. The software includes

- Java/JavaScript client application,
- PHP/MySQL chat server.

4.3.4.2 Audio and video chat

Audio and video chat web applications were typically based on the Flash Platform. Some typical examples of Web-based audio and video chat tools are presented below.

AVChat 3 (<http://avchat.net/>) is a Flash Video Chat Application that can be installed on a website. AVChat 3 supports one to one, one to many and many to many video chat scenarios. The quality is fully adjustable. In order to send audio, video and text between users, AVChat 3 (like most Flash video chat software) needs a media server. AVChat 3 supports Flash Media Interactive Server, Red5 and Wowza. Rtmpd support is in progress. As a result, the audio and video data exchanged between the users pass through the Flash multimedia server, so the video chatting does not occur in a P2P manner. The interface of AVChat 3 is illustrated in Figure 8.

Red5Chat (<http://www.red5chat.com/>) is a full FLASH video chat with audio and video support made using Open Source RED5 technology and Flash. Red5chat can be downloaded and installed in a Red5 Server. Some important features supported are

- Video chat
- Private Messages
- Registration process
- Fully customizable design
- Admin users
- Up to 4 video chat participants
- Rooms

MeBeam (<http://www.mebeam.com/>) is a video chat website, allowing anyone to create video conference rooms for up to 18 people. The website uses Adobe Systems Flash Player to display video and access the user's webcam. It works across Windows, Linux and Macintosh, along with any Web browser that supports Flash 8.

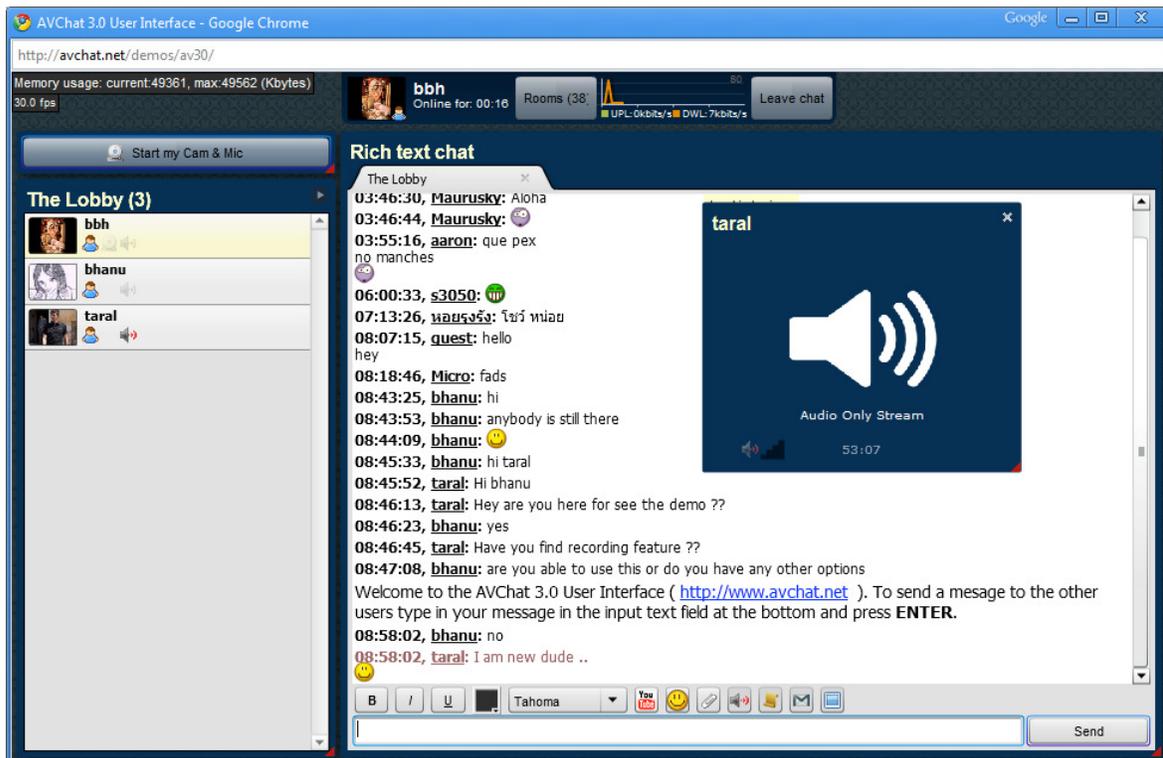


Figure 8 AVChat 3.0 video application service.

Peer to Peer Flash via Adobe Stratus (<http://apps.facebook.com/stratuschat/>)

Adobe Stratus is a hosted beta service that uses new Real Time Media Flow Protocol (RTMFP) functionality in Flash Player 10 to connect directly instead of having to round trip between the server and the instance of the player. In source [Rtmfp10] RTMFP is



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described as “a proprietary protocol developed by Adobe Systems. RTMFP enables direct P2P communication between multiple Adobe Flash Players and applications. The most important features of RTMFP include low latency, end-to-end peering capability, security and scalability. These properties make RTMFP especially well-suited for developing real-time collaboration applications by not only providing superior user experience but also reducing cost for operators”. It is worth mentioning that in order to have P2P communication between two clients when Flash technology is applied the only way is with the use of the stratus.

Web Voice Chat 1.2 (<http://www.fileguru.com/Web-Voice-Chat/info>) Web Voice Chat consists of a Public Room with textchat and Private Rooms for two users for face-to-face voice and text communication. The connection between users in the Private Room can be created as P2P or via server. Voice communication is implemented in full-duplex mode. Web Voice Chat requires 28.8 kbps Internet connection. So, usual dial-up Internet connection is enough for successful work.

Web voice chat is a client-server application with the client software being a Java applet, something that makes Web voice chat easily integrated in a website.

BigBlueButton (<http://www.bigbluebutton.org/>)

BigBlueButton is an open source web conferencing system that enables universities and colleges to deliver a high-quality learning experience to remote students. BigBlueButton supports sharing of slides (PDF and PPT), video, chat, voice (using Asterisk), and desktops. It's built using over fifteen open source components, runs on Mac, Unix, and PC computers, and is backed by an open source community that cares about good design and a streamlined user experience. BigBlueButton Plugin are developed for an easy integration in some CMS (like Drupal)

123 Live Help Chat Server Software 1.0 (<http://www.123flashchat.com>) offers software to one-to-one chat with website visitors, to promote sales with online customer support. It constitutes of a Java chat server and a Flash live chat client.

Table 4 lists some widely used chat tools and the underlying technology.

Table 4 Popular Chat tools

| Tools | Software Framework | Audio & Video Chat | File Sharing | Protocols |
|---------------|--------------------|--------------------|---------------|-------------|
| CGI:IRC | Perl/CGI | Not supported | Not supported | IRC |
| PJIRC | Java Applet | Not supported | Not supported | IRC |
| qwebirc | Ajax Applet | Not supported | Not supported | IRC |
| Parachat | Java Applet | Not supported | Not supported | Jabber/XMPP |
| Pichat | Ajax | Not supported | Not supported | Unknown |
| Facebook Chat | Ajax | Not supported | Not supported | Jabber/XMPP |
| eBuddy | Ajax | Not supported | Not supported | Jabber/XMPP |
| Omegle | Ajax | Flash | Not supported | Jabber/XMPP |
| webcamnow | Ajax | Flash | Not supported | Jabber/XMPP |

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|----------------------------------|-------------|---------------|---------------|-------------|
| JatChat | Java Applet | Java Applet | Not supported | Jabber/XMPP |
| campfire | Ajax | Not supported | Ajax | Unknown |
| Single Operator Ajax Chat | Ajax | Not supported | Ajax | Unknown |

Recent audio and video chat applications are also based on non-Flash technologies. Google Hangouts, described in the previous section, is a typical example.

4.3.4.3 Online voting and polling

An actual trend in Web 2.0 social applications is the use of Voting and Polling tools. Some typical examples of Web-based collaborative voting and polling tools are presented below.

VotingPoll (<http://acidjs.wemakesites.net/voting-poll.html>) is a Web 2.0 component for creating voting polls on webpages. It is fully Ajax-driven and extremely easy to integrate. Voting poll is illustrated in Figure 9.

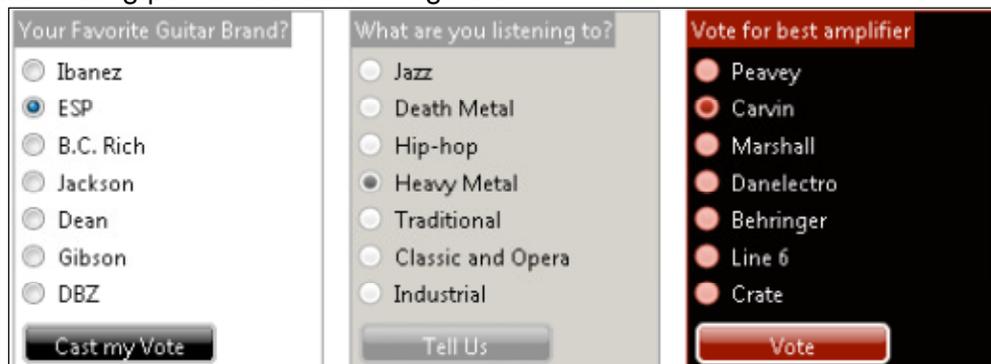


Figure 9 VotingPoll is an Ajax based voting application.

DPolls (<http://ajaxian.com/archives/dpolls-an-ajax-pollster>) is an Ajax application where interaction is performed in-page, without any need for refresh. A user that chooses an option will see a progress indicator appear, followed by an animation showing the results growing to their rightful size.

XML Flash Voting Poll (<http://www.flabell.com/flash/XML-Flash-Voting-Poll-39>) is a fully customizable XML Flash Voting Poll, built with support for an unlimited number of answers. Table 5 lists some widely used voting and polling applications and the technology that is utilized for their implementation.

Table 5 Popular voting and polling applications

| Tools | Technologies |
|-----------------------------|--------------|
| Poll4Web | Flash |
| Flash Web Poll | Flash |
| ABPollMaster Polling | Java Applet |
| Fly06 Poll | Flash |

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4.3.5 Web 2.0 Community Building Tools - Web Server Technologies

A very important aspect of the technology of Community Building Tools is the use of server side technology. In this section, we provide an overview of the server side architecture and we describe the state of the art for the server side components, along with the state of the art of their technologies.

4.3.5.1 Server Architectures

Multi-tier architecture (or n-tier architecture) is a client–server architecture in which the presentation, the application processing, and the data management are logically separate processes. N-tier architecture provides a model for developers to create a flexible and reusable application. By breaking up an application into tiers, developers only have to modify or add a specific layer, rather than having to rewrite the entire application over.

In the rest of this subsection, two types of Web architectures are reviewed:

- a) Architectures suitable for larger Enterprise Web Applications
- b) Architectures that might be used for Smaller Web Applications

Architecture for an Enterprise Web Application has four layers as shown in Figure 10.

- 1) A client layer which renders web pages.
- 2) A middle tier which includes:
 - a) A presentation layer which generates web pages, including their dynamic content. It interprets web pages submitted from the client.
 - b) A business logic layer which enforces validations and which handles interaction with the database.
- 3) A data layer which stores data between transactions.

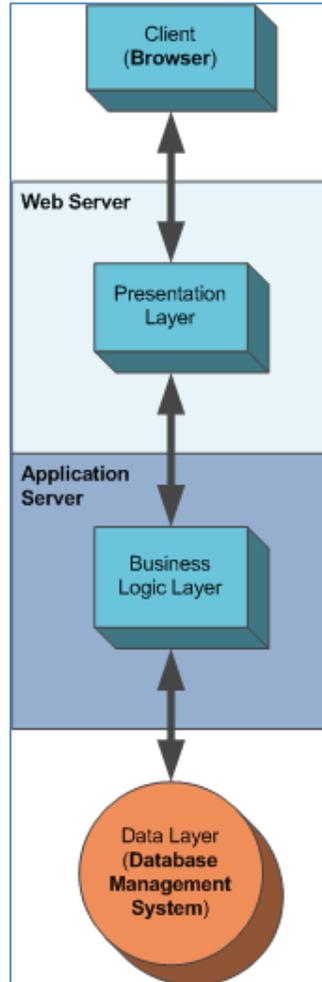


Figure 10 Enterprise Multi-Tier Web Application Architecture

Below, each layer is described separately.

The client layer of a Web application is implemented as a Web browser running on the user's client machine. It displays data and lets the user enter/update data.

The presentation layer generates web pages and it includes dynamic content in the webpage. The dynamic content typically originates from a database. The other major job of the presentation layer is to "decode" the web pages coming back from the client. The presentation layer can be built in a number of different tools. "The presentation layer for early websites was built as Common Gateway Interface (CGI) programs. Netscape also had server-side JavaScript for websites. Most modern websites presentation layers are built using: the Microsoft Active Server Pages (ASP) which may be generated by Visual InterDev, the Java combination of Servlets and JavaServer Pages (JSP) or other scripting languages such as PHP, Perl, Python, and Ruby.

The presentation layer is generally implemented inside a Web server (like Microsoft IIS, Apache WebServer, IBM Websphere, etc.). The Web server can generally handle

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requests for several applications as well as requests for the site's static web pages. Based on its initial configuration, the Web server knows which application to forward the client-based request to (or which static webpage to serve up)".

The business logic layer includes the bulk of the application. In more detail, it includes:

- performing all required calculations and validations,
- managing workflow (including keeping track of session data),
- managing all data access for the presentation tier.

In modern Web applications, business logic is frequently built using:

- the Microsoft solution where Component Object Model (COM) objects are built using Visual Basic or C++;
- the Java solution prescribed by Sun was used to build the business logic layer with Enterprise Java Beans (EJB). However, this has evolved to building the business layer using Plain Old Java Objects (POJOs) while implementing data persistence with simple Java Database Connectivity (JDBC) or using various persistence frameworks like Hibernate or Java Data Objects (JDOs). Heterogeneous back-end systems frequently provide additional logic and these applications are often accessed through a message oriented middleware via Java Message Service (JMS) in Java.

The business logic layer is generally implemented inside an Application Server (like Microsoft MTS, BEA WebLogic, IBM WebSphere, etc.). The Application Server generally automates a number of services like transactions, security, persistence/connection pooling, messaging and name services. Isolating the business logic from these activities allows the developer to focus on building application logic while application server vendors differentiate their products based on manageability, security, reliability, scalability and tools support.

The data layer is responsible for managing the data. In the simple case, a data layer may simply be a modern relational database. However, it may include data access procedures to other data sources like hierarchical databases, legacy flat files, etc. The job of the data layer is to provide the business logic layer with required data when needed and to store data when requested. In conclusion, the architect should aim to have little or no validation/business logic in the data layer since that logic belongs to the business logic layer. However, eradicating all business logic from the data tier is not always the best approach. Not null constraints and foreign key constraints can be considered "business rules" which should only be known to the business logic layer". Most would agree that it is safer/better to include such simple constraints in the database (and to change them, as the business rules evolve).

4.3.5.2 Simplified Model for Smaller Web Applications

The 4-level model presented above is appropriate for enterprise applications where there are many webpages and a significant amount of business logic. The Enterprise Model provides a clear delineation between presentation logic and business logic (which improves maintainability). Also, separating the business logic from the

presentation logic provides much more scalability since the intense business logic can run on separate server(s) under the management of application server software.

For smaller Web applications, it may be unnecessarily complex to have two separate layers in the middle tier (and specifically, it may be too much overhead to run a Web server as well as an application server). While it is still advisable to develop business logic in separate modules, a smaller application may run both presentation logic and business logic inside the Web server as shown in the **Hiba! A hivatkozási forrás nem található..**

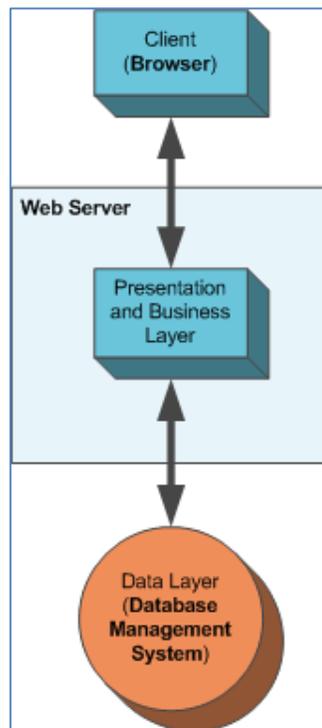


Figure 11 Simplified Multi-Tiers Web Application Architecture

4.3.5.3 Available Server software solutions

Apache HTTP server (<http://www.apache.org>) is a Web server software notable for playing a key role in the initial growth of the WWW. In 2009 it became the first Web server software to surpass the 100 million website milestone. Apache was the first alternative to the Netscape Communications Corporation's Web server (currently known as Sun Java System Web Server), and has evolved to rival other Unix-based Web servers in terms of functionality and performance. The majority of Web servers using Apache run a Unix-like operating system. Apache is primarily used to serve both static content and dynamic webpages on the WWW. Since April 1996 Apache has been the most popular HTTP server software in use, with the main competitor being the Microsoft Internet Information Services (IIS). As of February 2010 Apache served over 54.46% of all websites and over 66% of the million busiest.

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Apache Tomcat (<http://tomcat.apache.org>) is an open source servlet container developed by the Apache Software Foundation (ASF). “Tomcat implements the Java Servlet and the JavaServer Pages (JSP) specifications from Sun Microsystems, and provides a “pure Java” HTTP Web server environment for Java code to run. Tomcat should not be confused with the Apache Web server, which is a C implementation of an HTTP Web server; these two Web servers are not bundled together. Apache Tomcat includes tools for configuration and management, but can also be configured by editing XML configuration files”, source: [AT10]. The latest version of Apache Tomcat is 7.0.30.

Adobe Flash Media Server (<http://www.adobe.com/>) is used for streaming video and real-time communication mainly targeting collaboration activities. Applications connect to the Flash Media Server using RTMP and its variants, and the server can send data to and receive data from many connected users. A network connection to the server is similar to a large pipe and can carry many streams of data. Each stream travels in one direction and transports content between one client and the server. Each server can handle many connections concurrently, with the number determined by the server’s capacity.

The client application is developed in Adobe Flash or Adobe Flex and runs in Flash Player, AIR, or Flash Lite 3. It can support audio and video chat and handle user interaction. The server application runs on the server which manages client connections, writes to the server’s file system, and performs other tasks. The client must initiate the connection to the server. Once connected, the client can communicate with the server and with other clients. More specifically, the client connects to an instance of the application running on the server. An example of an application instance is an online game with different rooms for various groups of users. In that case, each room is an instance. Many instances of an application can run at the same time. Each application instance has its own unique name and provides unique resources to clients. Multiple clients can connect to the same application instance or to different instances. At the time of this writing (June 2013), the latest version of Adobe Media Server is 5.0.

Red5 (<http://www.red5.org/>) is an open source Flash RTMP server written in Java that can be used for audio and video chat applications. It supports audio/video streaming (FLV and MP3), client stream recording (FLV only) and live stream publishing. Figure 12 depicts a service using the Red5 server. The red5Phone Flex3 client makes a NetConnection with the Red5 SIP application. When it receives a success response, it makes a remote “open” method call in the Red5 SIP application which creates a pair of SIPUser and RTMPUser objects for that user and instructs SIPUser to register the user with the specified SIP proxy. When the NetConnection is closed by the Flex3 client, the pair of objects is destroyed and the user is unregistered from the SIP proxy [SipPh10].

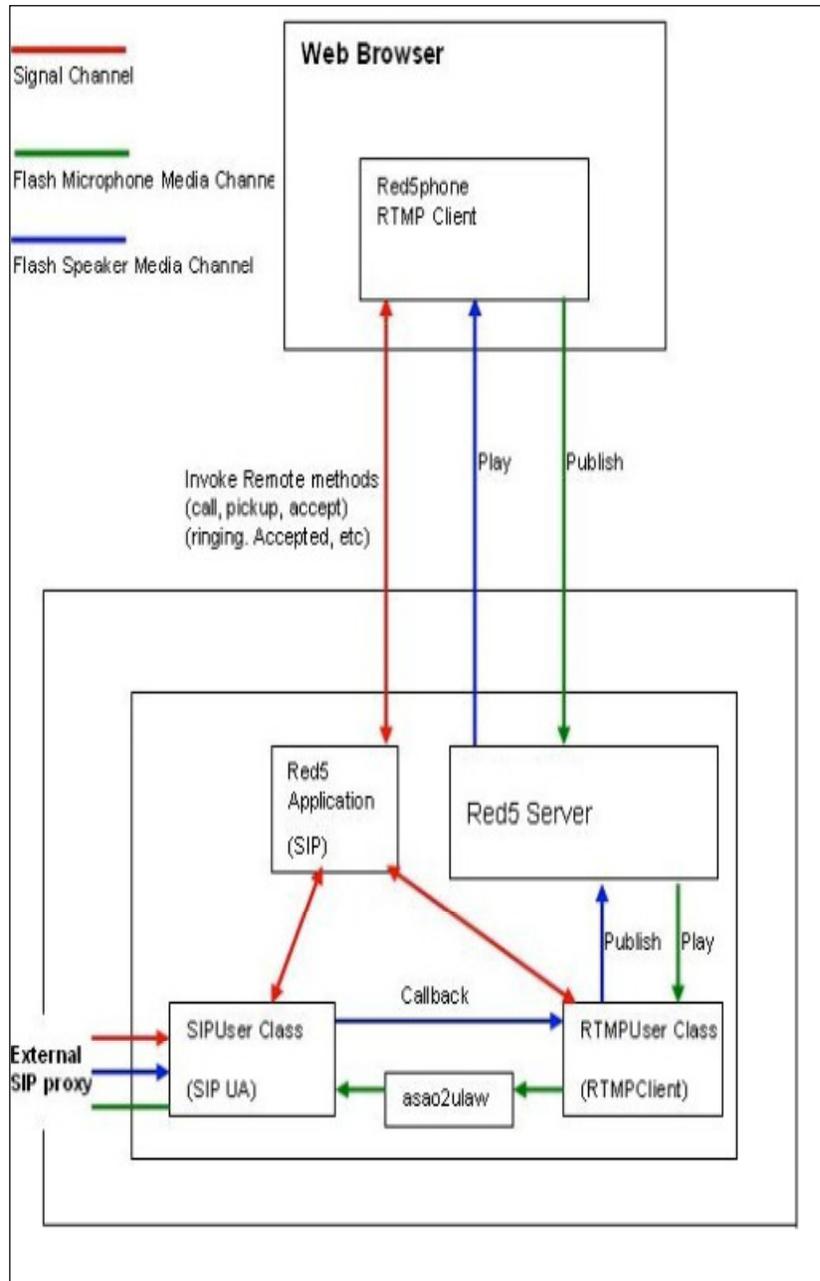


Figure 12 SIP service using Red5 server (source: [SipPh10]).

Other widely used Flash Streaming Media Servers are shown in Table 6.

Table 6 Popular Streaming Media Servers

| |
|--|
| Broadwave: allows the creation of broadcast from pre-recorded or live audio |
| Icecast: an open source streaming media server |
| PlayOn: a media server that runs on a PC and supports Netflix streaming |

| |
|---|
| SHOUTcast: audio streaming (HTTP and/or multicast) |
| Steamcast: a freeware streaming media server |
| Subsonic: an open source, Web-based media server |
| TVersity: a partially open source, Web-based media server |
| UltraStream SoundBox: a commercial media server based on IceCast |

4.3.5.4 Portal Architectures

Overview

While the word "portal" has become heavily overloaded in the software industry, it does have two primary definitions. The first definition, in a very generic and technology-independent sense, is a web-based gateway, likely to multiple systems, where users are presented with or can locate relevant content or information. Yahoo, iGoogle, and many corporate intranets are all examples of this generic definition. The information displayed to the user comes from disparate data sources, as depicted in Figure 13 Portal aggregates content from different information sources. Figure 13, and the portal aggregates the information to provide a consolidated view to the user.

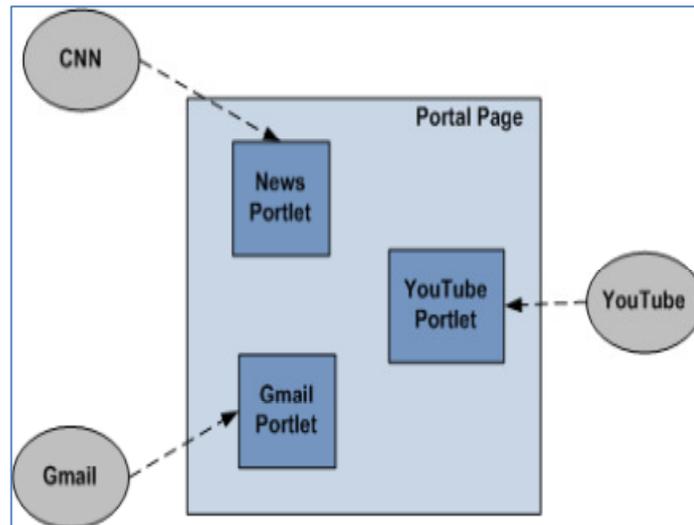


Figure 13 Portal aggregates content from different information sources.

The second and much more specific and concrete definition refers to a software architecture where a server-side component is used to aggregate content generated by small subcomponents called "portlets". Unlike servlets, which are traditionally responsible for generating a complete HTML page, a portlet only produces an HTML fragment. With multiple independent portlets on a portal page, the portal server composes the generated fragments of all these portlets into the full response, which is then returned to the user's browser.

From the perspective of an end user, many web applications emulate a portal (in the generic sense) and have a similar look, feel, and function, and therefore it's important to clarify the difference between a standard web application and a portal application.

Standard Java Architecture Web and Portal Applications

In Java a web application is an application based on the Java Servlet API. Whether the servlet API is used directly or indirectly through some MVC framework (such as Struts or Spring Web MVC), we refer to as a "standard Java web application". A portal application uses the portlet API, which uses the servlet API as its foundation, and so, a portal application can be thought of as a logical extension of a standard web application. Just as a web application relies on a servlet container that in turn uses the servlet API to invoke custom developed servlets, a portal application relies on a portal container that uses the portlet API to invoke portlets. The fact that a portal container relies on the servlet API is largely hidden from the portlet developer and it is the underlying usage of the portal architecture and Java Portlet API that distinguishes a web application from a portal application (in the specific sense).

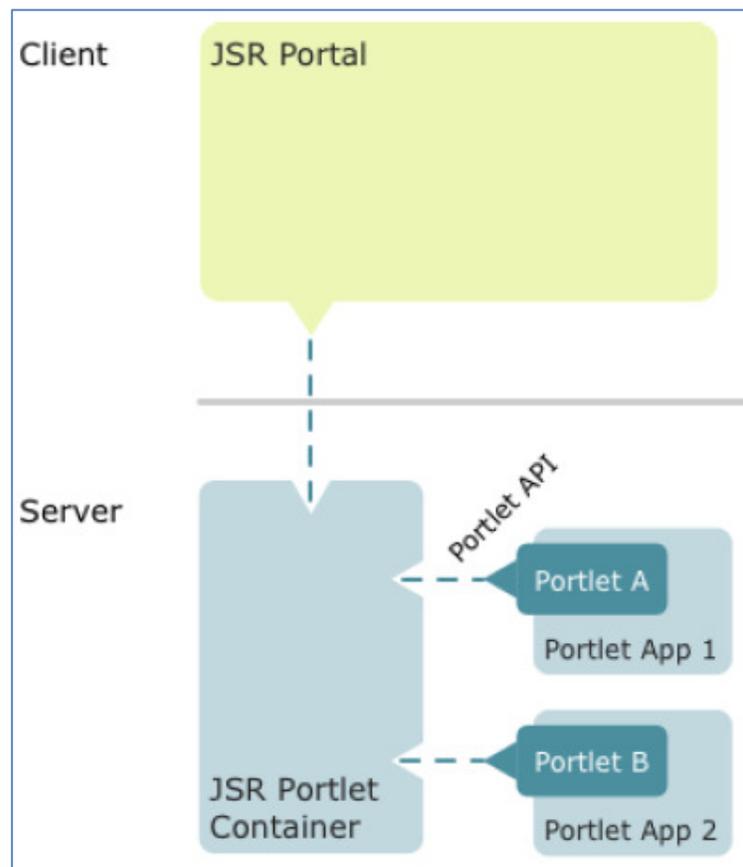


Figure 14 Traditional JSR model of a Java Portal

Portal and Web Applications Tradeoffs

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There are many architectural tradeoffs when choosing between building a standard web-based or portal-based application. In building the former, an organization has total control and flexibility over the design and architecture of each layer within what will become your system. In doing this, they are assuming the freedoms as well as the responsibilities of designing and implementing both the application's architectural infrastructure and the application's custom business logic.

Along with this control and flexibility comes the disadvantage that the application will be a homegrown, in-house custom solution; that this type of development can require developers with a great deal of experience and expertise; and that building the application infrastructure as well as the custom business logic will obviously take more resources and time than if you were building just the custom business logic itself. This is the typical "build it ourselves" approach.

The portal architecture tries to change all of that. With the goal of reduced development time and therefore reduced cost, a portal server attempts to provide out-of-the-box implementations of much of the common functionality that any web-based application would require. The standard features found in portal encompass:

- role-based security (including authentication and authorization),
- user registration and administration, management of user passwords by users,
- support for UI themes, personalization, and customization

For developers, writing custom software for the portal architecture is different than for a web application. The premise is to confine the custom development to the discrete portions of individual functionality of each portlet and leave the previously mentioned functionalities to the portal server itself. In essence, the written custom code is confined at the portlet level and are loaded (plugging) from those portlets into a prebuilt portal server. The portal server market is fairly mature and several commercial as well as open source portal servers are available to evaluate and select from.

Integration Methods and standards

An important task of a portal is the integration of external web applications and information sources. Many of them are not part of the portal software but represented by heterogeneous external applications to which the portal provides a homogeneous user interface. Portlets play a central role to this task. There are different approaches taken by portal software how external content and applications can be integrated. In the following subsections, we discuss the integration of web-based applications, the integration of static and dynamic content.

IFRAME

The simplest integration approach is the IFRAME technology, which is based on the inline frame concept of the HTML language. With a generic IFRAME portlet existing websites can be embedded into the portal with little effort. However, the webpages are inserted as they are and cannot be modified. The IFRAME is supplied to the client browser together with a source URL. The browser establishes a separate connection to the source application and inserts the application markup into the IFRAME window.

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Hence, the aggregation of the web pages takes place within the client browser rather than the portal server software (Lytras & Naeve, 2006).

IFRAME represents a simple method to integrate external content into a portlet, however, this approach should be regarded critically. This method presents content based on the URL which has several tradeoffs:

- a) must be accessible to the client browser,
- b) the portal server cannot guarantee whether the browser is allowed to establish a connection to the source since firewalls may intercept the communication,
- c) there is no possibility for other portlets to communicate with the IFRAME source as they run in completely separate server environments.

Web Clipping

With Web Clipping, you can clip an entire web page, or a portion of it, and reuse it as a portlet. You can clip basic and HTML-form-based sites. The use of Web Clipping allows copying a part of or the whole content from an existing web page and exposing it in your Framework application as a portlet. The server fetches the content from the source and merges it into the portal page. For this purpose certain HTML elements (typically the header) are removed. Additional modifications may be necessary. In particular links within the web pages need to be rewritten such as they point to a URL which is interpreted by the portal server rather the source application. As the portal server acts as a kind of intelligent proxy, only the connectivity from the portal server rather than the client browser to the application needs to be ensured. In addition, content caching becomes possible. More powerful web clipping supports by the server software the removal of certain HTML tags. Certain content areas can be selected, unwanted or redundant information can be eliminated and sometimes the visual appearance can be altered and adapted to the desired appearance of the portal. However, an important restriction of the web clipping approach is that cookies cannot be used as it is the portal server rather the client browser that communicates with the application. Moreover, the application behind the integrated fragment is still treated as for the IFRAME and suffers of the same limitations for portlet inter-communications.

JSR-168/286/301

These are standards found in Java server technologies.

JSR-168 (Abdelnur & Hepper, 2003) has been introduced into the Java Community Process (JCP), the official organization overseeing improvements to the Java platform. JSR-168 standardized the services offered, the basic portlet programming model, and the API, which then ensured portlets were cross-vendor and -server compatible.

JSR-286 (Hepper, S.; IBM, 2008). While JSR-168 laid the foundation for the portal architecture, it lacked many features that applications and developers needed. This forced developers back into creating non-portable, vendor-specific solutions, which therefore defeated the very purpose of having a portal specification. Such was the state of Java portal development until June 12th, 2008, when the specification for the next generation of Java-based portal software, JSR-286, went final and was publicly released. After nearly three years of development, JSR-286 was created to enhance

JSR-168 and improve upon its shortcomings. Some of the major enhancements of JSR-286 include inter-portlet communication, WSRP 2.0 alignment, support for Ajax, and portlet filters and listeners. For a discussion of WSRP 2.0 see SOA and Web 2.0 integration standards, hereafter.

SOA and Web 2.0 integration technologies

OASIS WSRP v1 & v2 (Thompson R., IBM, 2008) defines a set of interfaces and related semantics which standardize interactions with components providing user-facing markup, including the processing of user interactions with that markup. This allows applications to consume such components as providing a portion of the overall user application without having to write unique code for interacting with each component.

An implementation of WSRP can be found for JAVA in the JSR-286 which adheres to the 2.0 version of the interfaces.

WSRP defines an interface and protocol to handle user interaction and provides presentation fragments for the aggregation process. The generic architecture of the WSRP integration model is depicted in Figure 15.

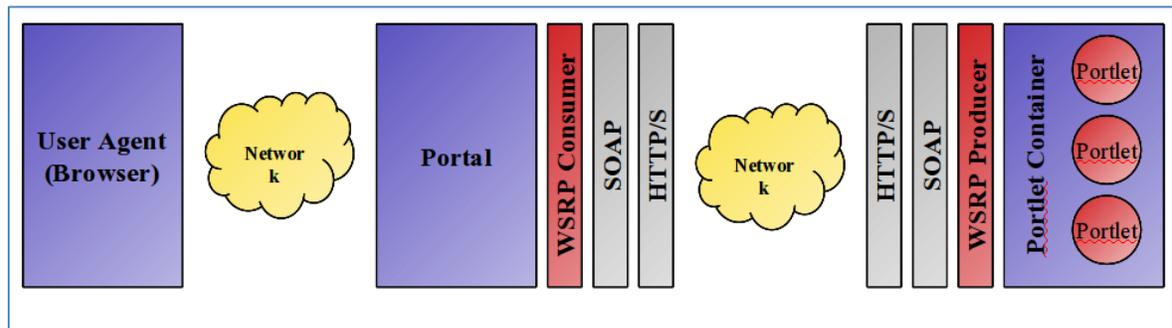


Figure 15 WSRP Portal Architecture

The standard defines four actors:

- a) The WSRP Producer is the portlet runtime, the container of the portlets.
- b) The portlet itself.
- c) The WSRP Consumer is a portal that aggregates the produced fragments to be presented to the end-user.
- d) End-User is the client browser where the portal is presenting the aggregated information.

The interaction flow between the different actors is depicted in Figure 16.

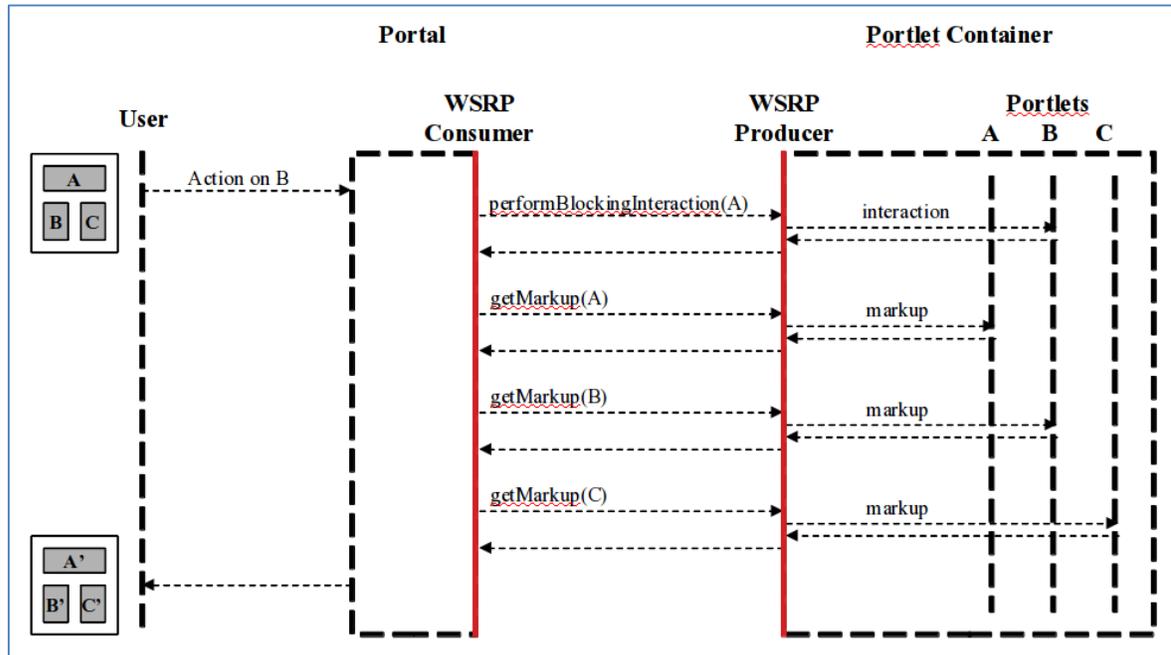


Figure 16 WSRP Activity flow

The benefits of WSRP are the decoupling of the aggregation process from the presentation, scalability of the model which allow portlet to run in another container and furthermore from another source application and lastly it provides interoperability from the use of WSDL that describes the WSRP portlet service.

Opensocial, [<http://opensocial.org/>]

The OpenSocial specification is simple and elegant, and incorporates most of the capabilities found in the WSRP and JSR-168/286 specifications. Unlike the portlet specifications, particularly WSRP, OpenSocial enjoys wide adoption because it supports hundreds of thousands of gadgets that millions of users are already familiar with. Google was the first to realize the potential of embedding content from other websites using simple XML and JavaScript. Together with MySpace and a number of other social networks, Google developed a common API for web applications. The OpenSocial specification for content syndication and social enablement evolved from the WSRP and JSR-168/286 API.

The specification and the approach have all the benefits that earlier standards promised, but none of their complexities. The following features are implemented in the version 2.0:

1. **Componentization.** Gadgets allow you to turn applications into portable components. OpenSocial provides a standard container to reassemble gadgets into views. As OpenSocial becomes more prevalent in the enterprise, you can mix more things together.

2. **Easy to develop, fast to learn.** OpenSocial uses common Web technologies: HTTP, XML, AJAX and REST. OpenSocial Gadgets are well documented, and there are plenty of resources on the web to get started.
3. **Broad developer ecosystem.** The iGoogle Gadgets Directory have a catalog of more than 333,500 gadgets (June 2013) that are developed by the community.
4. **Data interoperability.** Most apps may not seem “social” but nearly every application creates a network of relationships between people and things that may be useful.
5. **Integration at client side.** Rather than server side integration, Gadgets implements client-side semantics.

The last feature is of particular importance which contrasts with the previous methods. The Client-side model of integration, depicted in Figure 17, shows the conceptual differences with the previous (Java) portlets standards. In the traditional JSR portal model, a portlet container hosts any number of portlets. Each portlet generates fragments of markup, which the portal ultimately pieces together to create a complete page that is presented to the user.

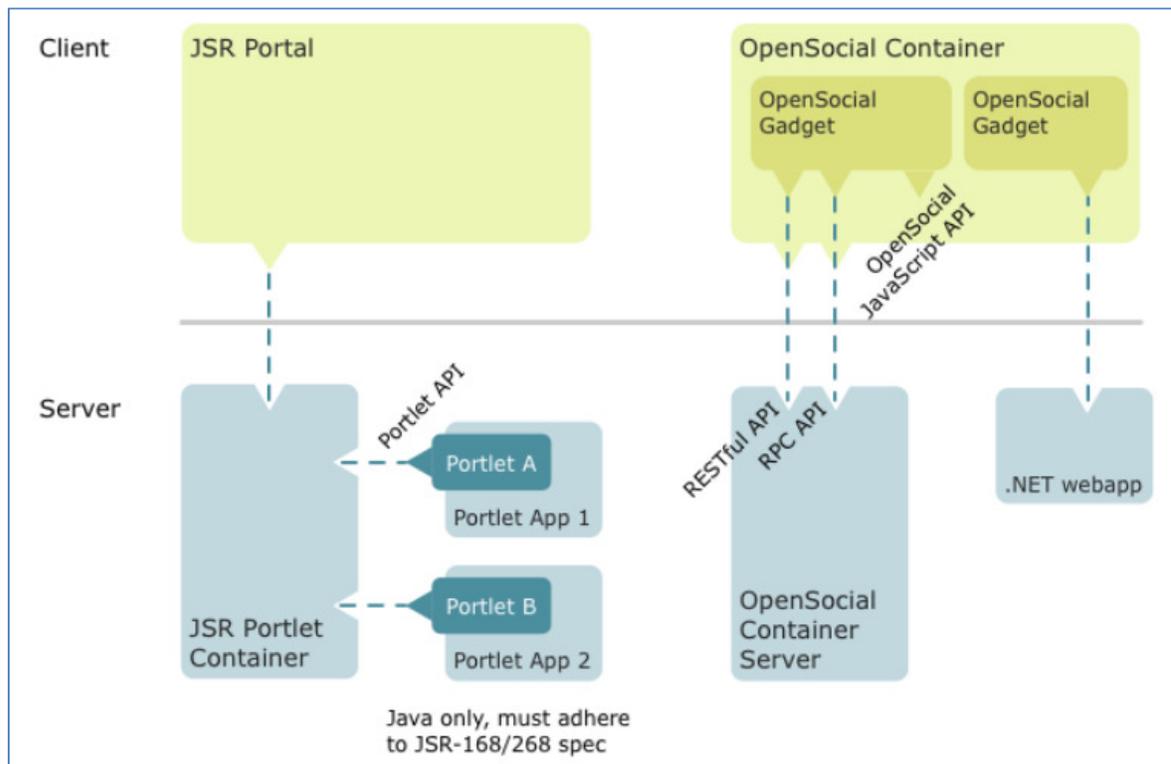


Figure 17 Client-side model of integration

An OpenSocial application runs inside an OpenSocial container. The container provides an OpenSocial Javascript API as well as pass-through support (via standard JavaScript libraries) to the RESTful protocol API and RPC protocol API. These APIs are used by the container to communicate with the OpenSocial container server.

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The two approaches differ in where rendering happens. In the JSR portal model, markup fragments are rendered on the server side and passed to the client (and ultimately to the browser), whereas in the OpenSocial model rendering is mainly done on the client side.

The approaches also differ from a flexibility point of view. A JSR portlet must be coded in Java and must adhere to either the JSR-168 or JSR-286 specification. An OpenSocial gadget can be hosted on any server and architecture. It could be a .NET webapp running in a remote server, for example.

Initially, OpenSocial emerged from the demands of consumer-facing social networking sites, like MySpace, LinkedIn and Ning. It was envisioned as the glue that would bind social applications together. A number of developers started working on the specification thanks to its popular application. The specification made accessing and sharing user profile, relationship and activity data much easier. As OpenSocial is evolving to Version 2.0 of the specification, the focus shifts to the business use and introduced a number of new features:

- **Activity Streams support:** a mechanism for defining rich and detailed social activities.
- **Simplified gadget format.**
- **Embedded Experiences:** running a service in a gadget.
- **OAuth 2 support:** OAuth is a common security mechanism that allows you to grant a site access to your private resources. OAuth is about giving access to your personal data without sharing his/her identity at all or part of it.
- **Common Container:** a new specification for the container that enables better interaction with gadgets.

Those features allow business applications to use OpenSocial as a general Web application integration technology by providing open standards for browser-based components and for non-browser/UI data transfer. The REST specification allows a server-to-server protocol opening B2B communication possibilities.

OpenSocial 2.0 is becoming very attractive for enterprise use. It has been embraced by Alfresco, Atlassian, Cisco, eXo, IBM, Jive, Lockheed Martin, SAP, SocialText and others who have built containers for it.

Mashups [[http://en.wikipedia.org/wiki/Mashup_\(web_application_hybrid\)](http://en.wikipedia.org/wiki/Mashup_(web_application_hybrid))].

Mashup is a Web page or application that uses and combines data, presentation and functionality from two or more sources to create new services. Mashups are wildly popular in modern Web apps. Mashups make it possible to integrate business and data services quickly. You can combine company-internal services with external or personalized information, and make those services tangible to users through user-friendly browser interfaces.

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5 The Web of Gaming

5.1 *Online Game Markets and Trends*

5.1.1 Social Gaming

Social gaming - games hosted on social networks such as Facebook that are meant to be enjoyed and played with friends - has taken off in the past year, and online gaming companies are closely watching this growth for even more social games such as bingo. In a recent special report on Internet bingo in eGaming Review, Peter Trinz, senior vice president for Internet bingo software developer Parlay Entertainment, was quoted as saying: "The social networking phenomenon has run parallel to the development of the bingo product. Bingo is a social game and people now feel very comfortable interacting on the Internet." (KPMG, 2010).

According to a study by media analyst Screen Digest, with growing broadband penetration, increased promotional activity, a trend towards regulatory relaxation and the current economic downturn driving demand for in-home entertainment, online bingo has become the fastest growing sector of the online gaming market and offers huge potential for further growth. (KPMG, 2010)

5.1.2 Mobile Gaming

With consumers increasingly comfortable using their mobile phones for products and services such as mobile banking, wireless Internet via 3G networks, and picture and video messaging, mobile gaming is likely not too far behind. While sports books have long taken advantage of sports-related subscription services to provide updates and scores, the mobile gaming market may still be fairly untapped, and its potential size may be huge. For example, mobile gaming will enable bettors (or punters) to place bets at an event or at a bar or pub while watching a game. Live streaming of sporting events via faster 3G connections has the potential to further enhance this market.

5.1.3 Serious Gaming

The general idea of serious gaming is that by employing more fun into a training process people will be more motivated to learn. The phrase "serious games" was coined by Clark Abt in his 1970 book "Serious Games" (Abt, 1970). Abt used his definition on card and board games, but his ideas are still valid and do apply to computer based serious games. Although the entertainment factor is not the main focus of the game, developers must strive to make the game as entertaining as possible without compromising the goal of the game.

Although the numbers varies, the size of serious game market is promising. There are not much reports and analysis currently available covering the serious game market extensively, which is because of the fact that, serious games domain is not defined clearly. (Montandon, 2013)

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5.1.4 Discussion

There are major changes in the IT market in general that have a direct impact on the games market and so the serious games market as well. The rise of smart phones, mobile apps and application stores are changing the shape of the business as well as associated business models. The dynamics of mobile gaming has major differences compared to desktop/console gaming. Fast take up in social networking and so social gaming in parallel is another significant trend. Another breakthrough is that cloud computing makes Software as a Service (SaaS) models possible modifying old revenue models from subscription based to pay-per-use type.

The deliverable *D41 Report on service alternatives, business models and impact estimation* will more specifically cover the trends and their effects to the existing business models taking into account the following dimensions:

- Social gaming
- Mobile gaming
- GaaS models (Game-as-a-Service)
- Freemium models
- Social innovation games
- New models of financing (by governmental organizations, by sponsoring, etc.)

5.2 Online Game and Communities Services

The project M3W aims at creating an ecosystem of services empowering people to take care of their mental health. The first aim is to entertain the users with games while measuring and help them to retain their cognitive capacities; the second aim is to provide comprehensive information and proper support by Health Associations, professionals and peers for mental health and wellness.

Engaging people to actually be users of the M3W system is discussed here in terms of how well the M3W games should be integrated in the online gaming communities. The integration to online health communities has been discussed in Chapter 3.

We shall here describe the existing use of services and implementation systems from the gaming communities

5.2.1 Game Distribution and Promotion

The game distribution aims to provide game producers and consumers with an online market place. There are a few models to distribute and promote online games, beside conventional distribution channels, the advent of Interactive Digital Media Marketplace (IDM), driven by the Internet and the global economy, as received much attention from producers and consumers of online games or digital goods as a whole.

The IDM marketplace is not entirely new. Even before the current popularity of Massively Multiplayer Online Role-playing Games (MMORPG), online music stores, IPTV and a host of social network applications, the digitization of content had been driven by the convergence of web services with telecommunications networks and devices.

Today, the ubiquity of the broadband (and often wireless) Internet is at the center of how this content is produced, consumed, repackaged and traded. In such content delivery networks, there are various roles played by producers, consumers, and intermediaries (i.e. syndicators, aggregators and distributors) in the emerging marketplace. Typical examples of Interactive Digital Media include music, movies, games, software, books, social content on devices as diverse as networked TV sets, home and car entertainment systems, mobile communications devices, and online games consoles (Sharma, Tan, & Pereira, 2011).

The roles of syndicator, aggregator, or distributor are complex and their respective duties may overlap. However, there is no established understanding of what precisely these roles are (Pinard, 2002). Figure 18 illustrates the Digital Media Business Ecosystem (Morales-Arroyo & Sharama, 2010) where

- "Aggregation is the collection of content from a variety of sources.
- Syndication is the proactive streaming of such content (especially after a window launch period) to alternate and repeat consumer segments.
- Distribution is the conveying of digital content to the devices of consumers, incl. the billing and collection aspects."

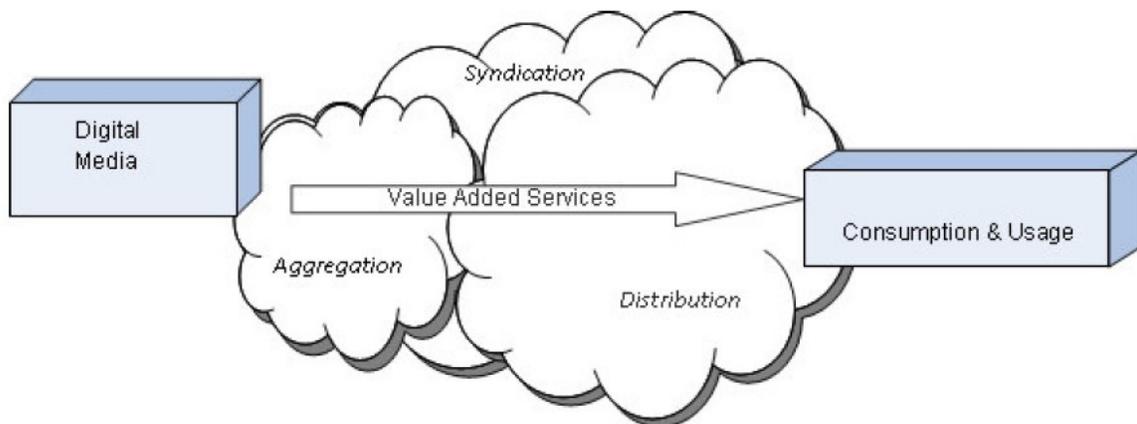


Figure 18 Digital Media Business Ecosystem (Morales-Arroyo & Sharama, 2010)

5.2.2 Game Monetization

What creates revenue? According to (Sharma, Tan, & Pereira, 2011) the answer is simple. Audiences are willing to pay for content that they are interested in, in this case, digital content. They point out that building an audience has never been an easy task. "Pricing the content has been a challenge in the digital ecosystem. Music Consumers do reject the idea of paying for a song they do not want nor are they willing to pay a price equivalent to CDs", source: (Sharma, Tan, & Pereira, 2011)

What then does an audience demand from digital entertainment? Typically, an audience wants good content (Sharma, Tan, & Pereira, 2011), variety of choices (Vogel, 2007), easy access, easy to find (Anderson, 2004), convenience, friendly interface, capacity to

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enjoy entertainment in different technological platforms and easy to transfer content from one into another (Jobs, 2008).

5.2.3 Game Digital Right Management

Digital Rights Management (DRM) attempts to give control to the seller of digital content or devices after it has been given to a consumer. For digital content this means preventing the consumer access, denying the user the ability to copy the content or converting it to other formats.

In the game industry, methods for such piracy prevention are varied, but generally involve restricting installation and file protocols in an attempt to make the game harder to copy, steal, or in some cases, even modify.

DRM is usually associated with PC games, although with newer consoles and IDM services like Xbox Live Marketplace, and the Playstation it has become to appear.

5.3 *Online Web Game Catalog*

5.3.1 Social Games

"Around 68.7 million Americans will be playing social games by 2012, according to analysis firm eMarketer" – wrote mashable.com in 2011. Well, 2012 came and the prognosis was correct. Why? How does it work: how is it possible that millions of people all around the world play social games instead of reading a book, playing soccer in the garden or just going to the cinema? There is something extraordinarily appealing about logging into Facebook or picking up your Smartphone and playing a game together with countless strangers across the world.

We spend more time with social gaming than ever thought before. Why? The only logical answer to the question is: social games are addictive. By checking the most popular social games on Facebook we just realized that being addictive has many different meanings. People are different, but winning, searching treasures, being better than the others, growing up animals or living an unreal, digitalized and wish-like life increase the adrenalin and helps to feel successful and happy. Although the addictive effect mostly depends on the personality, monitoring the statistics we might say: most of the people are able to be addictive to games regardless of their age or education.

Let's look at three of the most popular social games on Facebook and try to figure out why they're on the top (source: <http://mashable.com/2011/02/15/top-social-games>). At our selection we have preferred games deemed to be popular within our target group. The ranking is based on the top MAU (monthly active users) and DAU (daily active users) hit lists of <http://appdata.com>. A low value indicates a more successful application; a high value indicates a less successful application.

Words With Friends

DAU rank: 13 (1,000,000+), MAU rank 36 (10,000,000+).

[June 2013, <http://www.appdata.com/apps/facebook/168378113211268-words-with-friends>]

Imagine if Scrabble was available on your phone 24/7. Now imagine that instead of playing against a computer, you could compete with any of your friends whenever you want. That's *Words With Friends* (see Figure 19).



Figure 19 Word With Friends

Why does it work?

- Scrabble has always been very popular in every generation – all the Facebook users are in the target audience.
- No complication! *Words With Friends* works because it successfully emulates a classic game that everybody already understands — no need to worry about learning new rules or no need to think daylong about a new strategy against unknown enemies. It's just Scrabble, our friend from the kitchen table!

Strengths

- Simplicity – well-known rules
- Trust and faith for the old game
- Opponents can be friends

Weaknesses

- Nothing new, no challenge
- Old-fashioned
- Culture-dependent

Opportunities

- Social gaming on mobile with real opponents
- More old-fashioned games on the web
- Popularity among elders
- Performance related to cognitive capabilities

Threats

Possibility for the concurrency to copy model and games

Zuma Blitz

DAU rank: 324 (100,000+), MAU rank 377 (1,000,000+).

[June 2013,] <http://www.appdata.com/apps/facebook/113155018698187-zuma-blitz>

This addictive ball matching game is fun to play in both short and long doses, but its real strength lies in its scoreboard. As you go about your business in Zuma's Incan temple, you'll see a set of rankings on the right side of your screen after each round. Those rankings are constantly updated with your friends' high scores, allowing you to talk smack as you compete with one another for slot number one. It's a brilliant, simple, and effective technique that keeps players hooked for one simple reason: bragging rights.

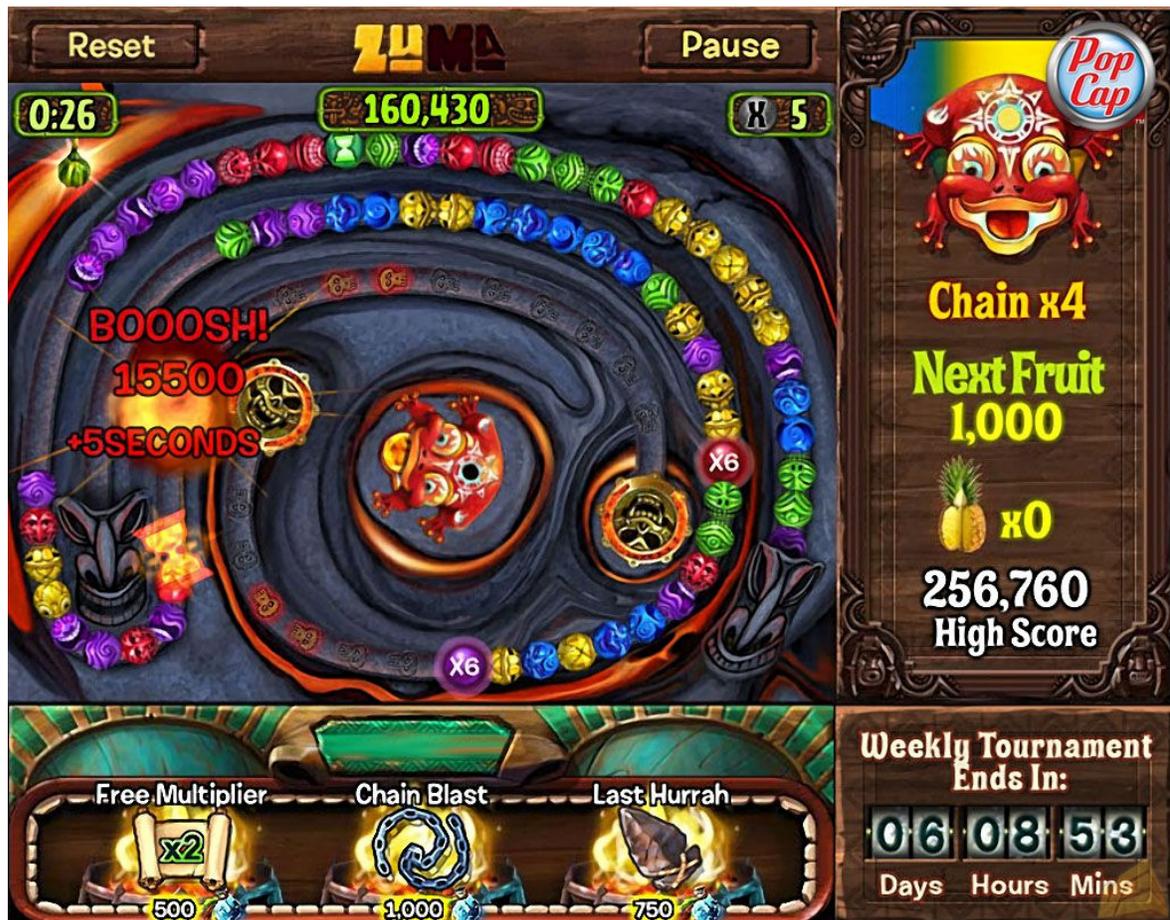


Figure 20 Zuma Blitz

Why does it work?

- Ball matching games have been very popular since the advent of computer games – all the Facebook users are in the target audience.
- Starter rules are simple and you learn more rules as you progress.

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- Colorful images, good sound effects and a great variety of scenes attract many people.
- Competition and comparison, as well as prizes and proud are important for the vast majority of people from children to elders.

Strengths

- Simplicity – easy-to-learn rules
- Simple manipulation
- Competitors can be friends
- Ranking lists and prizes

Weaknesses

- Mentally not challenging - may be boring for educated people
- Not well suited for measuring cognitive capabilities
- Needs regular deployment of scenes and gadgets

Opportunities

- Its successful patterns can be used for making other games attractive for many people
- Directly not much for the M3W project

Threats

- People get bored with the game

FarmVille 2

DAU rank: 7 (1,000,000+), MAU rank 3 (10,000,000+).

[June 2013, <http://www.appdata.com/apps/facebook/321574327904696-farmville>]

FarmVille is doing a lot of things right — that's why already in 2011 *FarmVille 1* was close to 10% of all Facebook users play it. But one of the most ingenious mechanics in this farm simulation game is the neighbor system. It's easy enough to harvest crops and build up your farm alone, but when you do it with your Facebook friends, your productivity skyrockets exponentially.

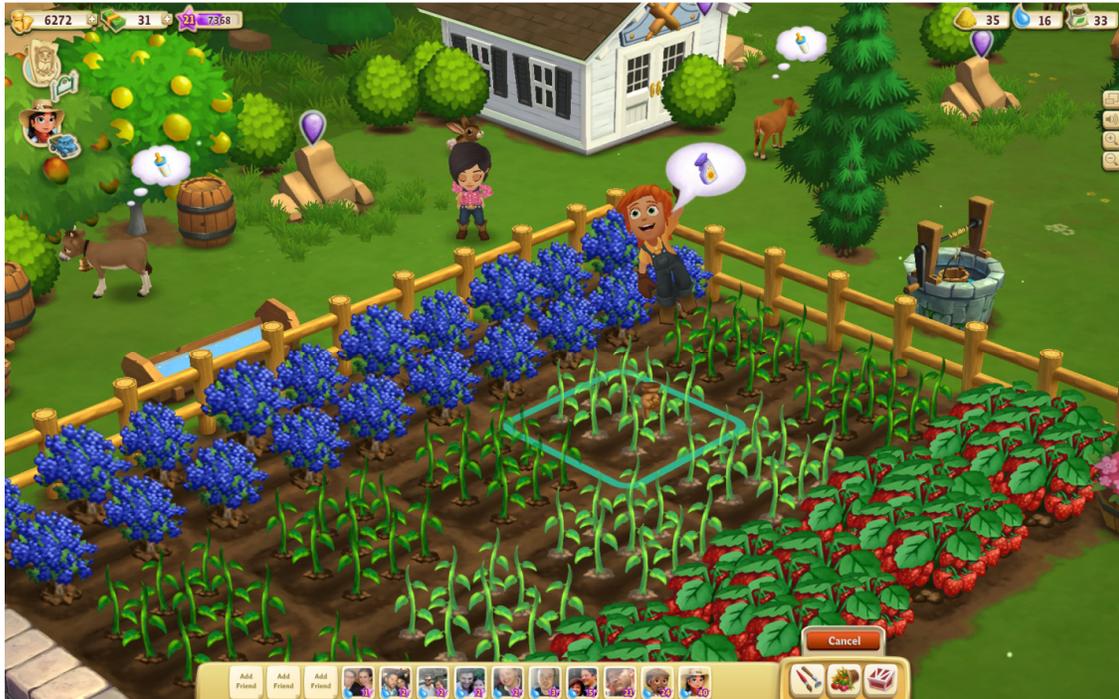


Figure 21 FarmVille 2

Why does it work?

- Simple rules for building up the farm and harvesting crops.
- Colorful images, good sound effects and a great variety of scenes attract many people.
- Cooperation and prizes are important for the vast majority of people from children to elders, maybe even more than competition and comparison.
- It is a real entertainment game, it does not use much of your brain or skills.

Strengths

- Simplicity of rules
- Cooperating partners can be friends
- It offers light entertainment for tired people

Weaknesses

- Mentally not challenging - may be boring for educated people
- Not well suited for measuring cognitive capabilities
- Needs regular deployment of scenes and gadgets

Opportunities

- Its successful patterns can be used for making other games attractive for many people
- Directly not much for the M3W project

Threats

- People get bored with the game

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6 Guidelines and Conclusions

This chapter is a concise preliminary catalog of system requirements that should answer or fulfill the user and technical requirements. It lists the constraints that drive the development of the system, and that will be verified during the system's test phases. The content of this chapter is or will be detailed in other deliverables, first of all

- D13 *Report on the functional, usability and technical-scientific criteria for the MWT,*
- D14 *Report on the measurement and evaluation methodology,*
- D15 *Report on elderly-tailored on-line games with measurement capabilities,*
- D23 *Report on service, portal and back-office development,*
- D41 *Report on the service alternatives, business models and impact estimation.*

During the Early Pilot (c.f. D11 *Report on the Early Pilot - System scope and boundary definitions*) we collected lots of experiences with distribution methods, web services, user expectations, user habits, security issues, etc. These experiences are built in the lists below as well as the deliverables mentioned above. In this chapter, we do not summarize what we performed in the Early Pilot phase - we have done it in D11 - but we describe shortly the conclusions.

6.1 M3W Framework and Games

The Mental Wellness Toolset (MWT) consists of the M3W framework and the games. The framework provides, among others, the following major services to the games:

- player authentication,
- uploading of gamelogs (data collected by the games),
- uploading of ologs (logs of framework and games operations),
- handling of languages (internalization),
- uploading and restoring settings of the framework games made by each user,
- temporary local storage of gamelogs and ologs (in case of temporary offline operation),
- uniform user interface such as layout (game area, message area, etc.) and appearance (buttons, icons, etc.).

6.2 Programming frameworks and client platforms

The components of the MWT (the M3W framework and the games) are written in JavaScript and HTML5. In order to simplify the development of games, special HTML5/JavaScript programming frameworks may be used by the programmers such as LimeJS (preferred) or MadeMove. However, the M3W framework does not restrict the programmer in utilizing other programming frameworks.

The main advantage of LimeJS (<http://www.limejs.com/>) is its platform-independence: it supports game development for all desktop browsers and modern touchscreens; its other advantage is its relatively large developer community. While MadeMove (<http://dev.creo.hu/mademove/mademove-introduction/>, <http://mademove.com/>) also supports platform-independence, it has a different advantage: we have direct contact to

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its Hungarian developers so they may take into account our needs for developing games for the MWT.

Nonetheless, since tablets and smart phones with touchscreens need different programming solutions than PCs with mice, additional development efforts were needed if we developed programs for both environments and their numerous variants. For the time being, our target group mostly uses desktop PCs and mice while the tendency is unquestionable: tablets are becoming more and more popular also among the elders. Because of our limited resources, we had to decide if we develop for the PC or the tablet.

Our decision is that we develop for the PC (i.e. our programs will be tailored for the PC) but we try to take into account also the specialties of touchscreen devices (buttons will be large enough to touch them by the fingertip; the 10" screen size and the 1280x800 resolution must be enough for the MWT, etc.). Smaller screen sizes and resolutions may cause difficulties for elderly people so we exclude smart phones.

Another aspect has to be taken into account when supporting two different platforms. Namely, if a person uses a PC with mouse and a tablet with touchscreen alternately, her/his performance may be very different as the two need very different skills. Thus, we have to separately evaluate her/his data and performance. It is partly true also when someone uses different PC configurations at different times (e.g. a desktop PC with large screen and big mouse, a laptop with smaller screen and mouse, a laptop with two screens and touchpad). The conclusion is the influence of the equipment environment may be high, and it must be considered at the evaluation of the measured data.

6.3 *M3W Framework and Games Distribution and Data Collection*

The framework and the games will be available on the M3W webserver via browsers. Only games registered by the game administrator (c.f. Section 6.5) are available to the players.

The M3W webserver runs under the Drupal 7 Content Management System (CMS). Its main task is, as far as the MWT is concerned, user registration and authentication. Only authenticated users will be authorized to use the MWT.

Alternative distribution methods are also taken into account. As the MWT is planned for the international market, more servers - mirror servers - may be used, and different access methods such as embedded services will be studied. We shall choose the appropriate solution(s) from the many technological possibilities described in the previous chapters.

Data collection is another important issue that may need a distributed solution, at least for two reasons: safety/security and privacy. Safety requires that the uploaded raw data be stored on physically distant servers, and backed up regularly. Privacy requires that sensitive data do not travel across borders (of countries, regions, institutions, etc.)

Privacy requirements are closely related to the way how user registration is handled. Since we also need other sensitive user data for the evaluation of the collected data (age, education level, etc.), and for accessing our players/patients (full names, phone

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numbers, email addresses) distributed user registration may be needed, especially after the development phase. (For the evaluation and validation of our approaches and methods we need even more sensitive data - results of medical examinations - but the handling of these data occurs in a special research environment so we do not deal with it here, in this chapter.)

All this means that the MWT should be prepared to work in a network of collaborating servers.

6.4 *M3W Portal Services*

The M3W system may utilize portal services of other systems for the distribution of the MWT. The M3W webserver itself will not be operated as a portal in the experimental period (in the second sense of portals, c.f. Section 4.3.5.4). Depending on the business model to be chosen, we may consider later to embed external webpages (e.g. ads) in the M3W portal e.g. in order to improve its sustainability.

6.5 *M3W User Collaboration*

There are various kinds of users in the M3W system who can play one or more roles such as

- Unauthenticated user
 - visitor – anybody, allowed to read the public pages of the M3W Webserver;
 - candidate – a self-registered user who has applied for membership, and either has to perform the so called PAL Test (see explanation in D11) to become player, or has to wait for confirmation to become authenticated user;
- authenticated user – a preregistered and approved user who can read other pages, contribute to selected webpages, e.g. the Forum, and modify his own profile;
 - player – a preregistered and approved user with the rights of authenticated user, who also has the right to play with the games of the MWT;
 - evaluator - an authenticated user who has access to the collected and anonymised measurement data,
 - doctor - an authenticated user with the combined rights of player administrator and evaluator,
 - game developer - an authenticated user who has the right to register a maintain games,
- Administrator
 - user administrator - an authenticated user who also has the right to register new users (all roles but system administrators), and see and modify their profiles,
 - player administrator - an authenticated user who also has the right to register new players, further see and modify their profiles (i.e. the player administrator has a subset of the rights of the user administrator),

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- system administrator - full rights to the whole systems.

Concerning authentication, each user must have a username/password pair to be used only in the M3W system, or an OpenID provided by Gmail, Facebook, MyOpenID or some other popular social media (c.f. Section 4.3.3.4). OpenID simplifies significantly the usage of the M3W system for inexperienced elderly users since they don't have to remember and use different usernames and passwords when using different websites.

Since players may be citizens of different countries and members of different communities, it may be required that their sensitive data be not accessible by all player administrators and doctors. Thus, players belonging to some community will form a group, and only player administrators and doctors belonging to the same group will have the right to look at and modify their profiles.

In order to provide even better privacy in the M3W system, we will examine the possibility of using more servers for player registration and administration. Whether centralized or distributed, the MWT gets only the authorization from the proper player server but no personal data.

Users of the M3W system may also form virtual communities. Our Drupal based webserver supports the creation of forums where the various user groups consisting of mixed players, players belonging to special communities, doctors, evaluators, developers, etc., may exchange their experiences and ideas. These virtual communities can also be joined with popular social media such as Facebook or Google+, however, we have to ensure that those elderly players of ours who are inexperienced Internet users or whose judgment abilities have been weakened remain in a protected bay.

Throughout the project, we also use mailing lists to be in contact with our players.

In the M3W system, user collaboration means both the usage of the MWT and the participation in the M3W Community supported by the CBT.

6.6 *M3W Data and Services Security and Confidentiality*

The M3W system uses SSL (HTTPS) for data transfer over the Internet. The outcome (success or failure) of each transfer operation is checked, and the operation is repeated in case of failure.

Principally, the games are played online. If the Internet connection stops temporarily the M3W system stores the data locally, and when the connection comes back, the data transfer is restarted. Even offline playing is supported as long as the same game is played in the browser, i.e. no new download is needed.

Distributed storage and mirrored servers will be used to increase the security of services. We shall study also the possibility of using cloud services for game distribution and data collection as the availability of clouds (e.g. Google Server) is high.

Confidentiality is ensured by using the advanced permission and access system of Drupal 7, both for granted access to persons (c.f. Section 6.5), as well as to programs (Drupal 7 support also the powerful REST web technology, c.f. Section 4.3.5.4).

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6.7 M3W Use of Standards

The most relevant state-of-the-art standards - protocols and technologies - listed and described in the previous chapters will be used throughout the M3W project where only appropriate. It is hard to decide now except the basic ones, i.e. JavaScript and HTML5, upon the standards that we will adhere to but they will be documented when the specification and design will be elaborated.

Uses of standards are the best guarantee for interoperability in a highly fragmented market of device and browsers. Create documents that validate to published formal standards: Send content in a format known and supported by the device and ensure that content is encoded using a character encoding known to be supported by the target device.

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