

Notes of the

Exploring the Future of Mobile Search

Expert Workshop

9th June 2010, Het Pand, Ghent, Belgium



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Agenda of the workshop

- 13:30 – 13:45 **Welcome and Introduction**
Stavri Nikolov (IPTS, EC), Loretta Anania (DG INFSO, EC)
- 13:45 – 14:30 **Invited keynote speech**
Mobile search: market opportunities and innovation potential
Peggy Anne Salz (MSearchGroove)
- Session 1: Socio-economic aspects of mobile search**
Exploring the socio-economic logic of mobile search
Jose-Luis Gomez Barroso (UNED)
The future of mobile search is social
Karen Church (Telefonica)
From location and social search to mixed reality
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Session 1 Q&A
- Session 2: Technologies and interfaces**
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Seeking alternatives: multimodal, social and lazy mobile searching...
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- 14:30 – 16:55 **Session 3: Services, applications and business models**
Mobile search in a touch-centred world
Steve Ives (Taptu)
Multimedia search for the mobile web
Pierre Scokaert (AB Phone)
Searching, finding, navigating with the Wikitude ecosystem
Philipp Breuss-Schneeweis (Mobilizy)
Session 3 Q&A
- 17:00 – 17:30 Coffee break and informal discussion
- Workshop and Think-Tank Roundtable discussion\ of the future trends and directions covering the technological and socio-economic aspects of Mobile Search**
- First Survey Results: Presentation and analysis of the results of the 2010 mobile search questionnaire**
Margherita Bacigalupo (IPTS, EC), Stavri Nikolov (IPTS, EC) & Pieter van der Linden (Technicolor)
All previous speakers
- 17:30 – 19:30
- How are mobile information needs changing?
 - How is the mobile search market likely to evolve?
 - Which are the major bottlenecks?
 - Which are the main challenges to be overcome?
 - How are mobile search usage patterns changing?
 - How is Europe placed with regard to the rest of the world?
 - Is there a consensus on future trends and directions?
 - What are the main technological and economical challenges laying ahead?

Objectives of the workshop

The "Exploring the Future of Mobile Search" workshop was organised by the Institute for Prospective Technological Studies (IPTS), which is part of the Joint Research Centre (JRC) of the European Commission, in the framework of the Chorus+ project. The main objective of the workshop was to gain insights into the techno-economic and socio-economic trends in mobile search and their impact on the European Economy and Society, in particular with respect to the new search services arising from the unique features of mobile devices and mobile environments, e.g. context-aware or location-based services, social (network) search, and interfacing with the "Internet-of-Things".

The workshop was organised to discuss and analyse the following aspects of mobile search:

- **Market Dynamics.** Painting the landscape of mobile search, including the current business models of providers of mobile search and the leading search engines (e.g. strengths, entry barriers, differences amongst them, etc.) and describe their value chain.
- **Future Prospects.** Identifying emerging techno-economic trends, discussing likely developments and future market structure in the domain of mobile search.
- **SWOT Analysis.** Exploring the strengths, the weaknesses, the opportunities and the threats (SWOT) for the Europe Union with respect to mobile search, focusing on economic drivers and the challenges influencing the future of search engines, as well as any other impediments (of regulatory, technical, economic, or social nature) that may hamper successful deployment in Europe

The workshop was co-located with the 9th Conference of Telecommunication, Media and Internet Techno-Economics (CTTE) and was held on 9 June in Ghent, Belgium.

The notes of the workshop which follow below are organised chronologically by session and within each session, by topic of discussion. Great care has been taken to respect the flow of the argument, which required, in some instances, changing the order of some contributions.

The workshop was opened by Dr Stavri Nikolov who welcomed the invited speakers and other participants in the workshop and provided a brief introduction to the Chorus+ project (<http://www.ist-chorus.org>). Chorus+ is a Coordination Action which aims to coordinate national and international projects and initiatives in the (audio-visual) search engine domain in Europe and to extend this coordination and cooperation to non-European countries. Following that, Dr Nikolov presented the objectives of the workshop and the agenda. Three thematic sessions were planned in the first part of the workshop to gather expert contributions on different aspects of the mobile search eco-system. A round table discussion was scheduled to follow in the second part of the workshop to foster debate around the core technological and techno-economic aspects of mobile search. This roundtable panel discussion was also organised as a Think Tank on Mobile Search (again within Chorus+) with a particular emphasis on technological future trends and directions in mobile search.

After the introductory speech, Loretta Anania (DG INFSO), Chorus+ EC project officer, addressed the audience with a brief talk on upcoming funding opportunities in search-related areas.

She referred to the thematic area of broadband and services (FP7, call 7) and to the objective ICT-2011.1.5 Networked Media and Search Systems, which aims to:

- a) develop digital media platforms and technologies overcoming the inherent limitations of the Internet as a media delivery platform;
- b) deploy immersive and interactive media technologies providing users with more sophisticated forms of media and enhanced experience;
- c) empower users to search the relevant media information corresponding to their usage and context requirements.

The multimedia search target is defined in terms of deployment over open platforms of scalable, multimodal, real-time media search technologies with search engines that facilitate and personalize fast access to web-scale digital media objects.

Loretta Anania reminded the audience that "search should not be seen as a service or a necessary function of the Future Internet, but rather as a key platform layer on which Future Internet applications can be built¹"; a layer where trust in the search engine, speed and scalability, simplicity, high relevance of the retrieved results are all crucial factors. She anticipated that Coordination and Support Actions (likely 2M€) are going to be funded to:

- Promote coordination of related national and EU-wide R&D programmes/activities
- Promote stakeholder coordination
- Disseminate results and organisation of scientific and/or policy events.
- Analyse international research agendas and roadmaps, pre-standardisation initiatives and preparation of concrete initiatives/projects for international cooperation so as to contribute to the mapping of long-term research needs and the development of prospective research and technology roadmaps.

She anticipated that *Info Days* are going to be held once the call is launched to help interested parties in understanding requirements and clarifying the scope of the call, also in relation to previously funded research projects. Most probably the first Info Day will be held during the 2010 NEM Summit, 13-15 Oct. 2010 (hosted in Barcelona).

Following the introductory speeches, Dr Nikolov gave the floor to the invited keynote speaker: Ms Peggy Ann Salz, founder, chief analyst and publisher of MSearchGroove (MSG) – <http://www.msearchgroove.com/> , a rich online source of analysis and commentary of mobile search, personalization, recommendation, social media and mobile advertising.

Peggy Ann Salz is considered an authority on mobile search and content discovery technologies.

¹ From the conclusions of the panel on 'Search' in the Future Internet held during the Future Internet Assembly (Valencia, 15th and 16th April 2010)

Mobile search: market opportunities and innovation potential

Peggy Ann Salz: keynote speaker

Peggy Anne Salz is the chief analyst and founder of MSearchGroove, a top 50 influential technology site providing analysis and commentary on mobile search, mobile advertising, and social media. Her drive to spark debate about issues impacting the industry at all levels has won her international recognition as a brave new voice in the mobile content market. Her report, "Mobile Search & Content Discovery," was regarded as the first in-depth study of its kind, establishing Salz as an authority on mobile search and content discovery technologies. Her most recent series of practical how-to white papers covers the basics of mobile advertising and mobile analytics, laying the groundwork for her next project: a mobile marketing primer endorsed by several mobile industry organizations including the Mobile Marketing Association (MMA) and the Mobile Entertainment forum (MEF). Peggy has established a successful career based on vision, insight, versatility, and more than 15 years of industry experience. Her work, which includes more than 300 articles on mobile content and applications, has appeared in magazines and online destinations such as The International Herald Tribune, The Wall Street Journal, Mobile Entertainment, Mobile Media, New Media Age, and in the Agile Minds column in EContent magazine, among many more. Graduating with honors from the University of Pittsburgh, Peggy earned a B.A. in Philosophy of Science, Political Science, and Economics. She is a Fulbright fellow and a member of the International Who's Who of Professionals.

The keynote talk focused on **the revenue generation aspects of mobile search as the intersection point between content and context.**

Salz firstly presented a brief market overview, based on recent data. She started with a snapshot of mobile usage, where she highlighted that according to the 2010 data provided by ComScore covering EU 5 (UK, France, Germany, Italy, Spain):

- Usage behaviours are changing and mobile devices are not (only) phones anymore
 - o 34% of Mobile Phone Owners Browse the Mobile Internet, Use Applications or Download Content (Mobile Media Users).
 - o The number of people who are just using voice has declined 15% year on year.
- Mobile Media Users (mobile browsers, application users and content downloaders) grew 22% year on year (YoY)
 - o There are almost 13.7 million extra mobile media users in March 2010 than in March 2009.
 - o The increase from November/December 2009 is due to many people receiving new devices around this time (Christmas gifts) and using their new functionalities.
- Key Market Enablers keep growing
 - o Two of the market enablers (smartphones and 3G devices) are now firmly entrenched in the market.
 - o The most important enabler, **unlimited data plans**, still has limited penetration in EU5 (6%) however did grow 71.8% year on year.
 - o In comparison 24% of US mobile users subscribe to unlimited data plans.
- Usage patterns are different depending on age and gender
 - o The Average Mobile Media User is 33 and 41% are Female
 - o Younger users create their own ringtones, use social networking services and listen to music (web 2.0 type services).
 - o Mobile Internet services (browsing, apps and e-mail) skew 60-65% Male
 - o Women represent a new market, still very much underestimated

When it comes to the Mobile Web, browsing and search activities data show that:

- Whilst the number of smartphone owners has increased 37% YoY there have been significant changes in the share of different operating systems (OS).
- Over the Past Year Symbian Has Lost Smartphone Market Share
 - o Over this period Apple has grown to almost 17%, from 8.5%. Microsoft has dropped from 16% to 13.6%.
 - o Although Android has very low penetration, it now represents 2.5% of smartphone owners in the EU5

- The mobile web has taken up:
 - o There are over 17 million extra mobile Internet users in March 2010 compared to March 2009, which represents a 43% growth.
 - o Social networking users are showing the highest gains with 98% YoY growth.
 - o 12% are using instant messaging (IM) and users are growing 37% YoY.
- The entry to the web via mobile is more and more often mediated by Google:
 - o Google is the Most Popular Mobile Internet Site in the UK
 - o Followed by Facebook (though Facebook's users spend 11 time more time on that site than Google users do on Google)
 - o Vodafone comes third and is the leading operator portal

When it comes to mobile search, Google leads and all other players lag far behind:

	Total	% Searchers
Search: Google	22.363	75%
Search: Yahoo!	3.202	11%
Search: MSN / Windows Live / Bing	2.080	7%
Search: Other	1.984	7%
Search: Operator	1.749	6%
Search: Vodafone	1.377	5%
Search: AOL	621	2%

However:

- While 80-100% of PC Internet browsers use search, depending on the EU country, only around 40% of mobile browsers use search
- ComScore data show that the mobile internet is as much about connecting with friends and family as it is about news and info. (Though mobile devices are not phones anymore, they are primarily connecting devices)

Peggy Ann Salz proposed the following classification for mobile search applications and players.

	Applications	Players
Interface	Text	ChaCha, 4 INFO, mINFO,, Answers.com, AnyQuestionAnswered (AQA), Ask, AskMeNow
	Voice	Technology providers: Nuance Service providers: Google, Yahoo, Vlingo, Microsoft
	Visual	IQ Engines, Kooaba, GetFugu, Searchme, SnapNow, SnapTell (Amazon), Tin Eye Mobile, Nokia
	Navigational	Boopsie, Kannuu, Nuance (T9)
Actionable	Universal	Google, Yahoo, Microsoft
	White Label	On-portal
	Federated	MCN, Motricity
	Operator-centric search	Amdocs, Openwave, Qualcomm, IBM
	Alternative search engines	Long tail of some 1500 search engines
	Vertical/content	ABphone, Vtap, Truveo

	Local search	Hundreds of players PLUS SMS search, WAP & Shopping (NearbyNow, Aisle 411, Aloqa, Geodelic, WHERE)
Sociable	Social Search	Taptu, ChaCha, Hiogi, ABphone, 192.com

Salz condensed the mobile search issues in terms of **intersecting content and context** to provide the matching between users' information needs (and desires) and a relevant selection of results.

Tailoring search results to individual users' interests and intents is to be achieved by modelling context from users' time, location, and interests (which are user's context attributes). Salz referred to the findings of recent research² indicating that interest is the most influential attribute, followed by time, and then location, pointing to the fact that location is normally regarded as a very strong context attribute (at the basis of location-based search).

Context modelling is thus the key to the filtering of information and to the dynamic personalization of search results (real-time search). The dynamic personalisation of search results can be increased by blending context-aware engines with recommendation systems (a recent survey from Jupiter Research shows 64% of users will try a service or content recommended by a friend, and 69% will pass what they like along to between two and six friends).

Salz recognises that recommendation solutions are being implemented in a number of different forms, such as:

- **Mobile Portal Personalization:** adaptation of navigational elements, content listed, ads served and personalized search results (e.g. Changing Worlds, Choice Stream, Media Unbound and Leiki)
- **Content Discovery and Recommendations:** pure content discovery and recommendations across content types (e.g. Xiam, FAST)
- **Subscriber segment targeting:** user profiling and segmentation as part of an online marketing campaign (e.g. Coremetrics and Pontis)
- **Influencer targeting:** profiling and identification of influential subscribers (e.g. Xtract and Strands)
- **Mobile advertising solutions:** inventory targeting (e.g. Jumtap, Aggregate Knowledge, Velti/Ad Infuse, Medio and Wunderloop)
- **Web (non-mobile) Product/Content Personalization:** cross-channel product and content recommendations optimised for retailers, web and media (e.g. ChoiceStream, Loomia, Aggregate Knowledge)
- **Business analytics:** product/offer bundle recommendations based on user segmentation and real-time behaviour analysis (e.g. Olista, Oracle, ThinkAnalytics and Coremetrics)

Salz concluded her talk by pointing out that, though people are relying on mobile search to discover content (with some 68% using search engines to find what they want and 58% type in the URL), when it comes to effectiveness – people report URLs (83%) and bookmarks (89%) are the best ways to find content. Mobile search comes in a close third.

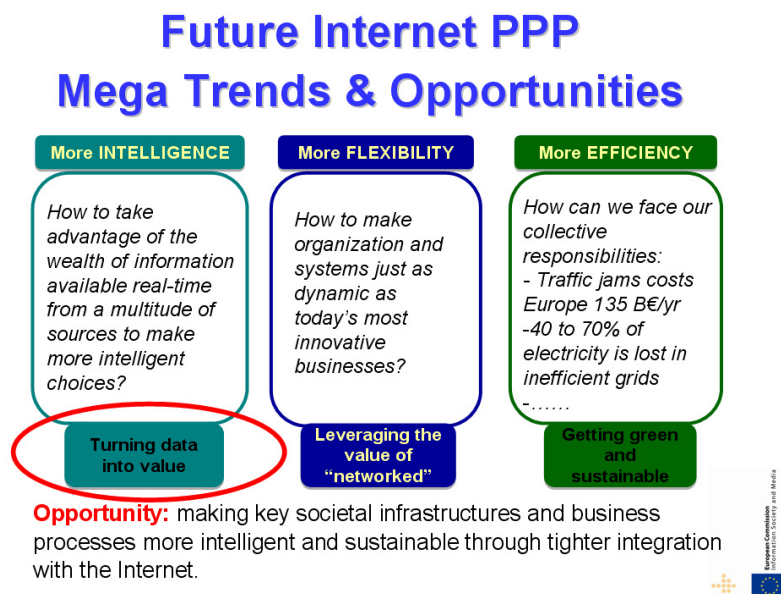
In the question and answers session following her talk Salz addressed more in depth the importance of content discovery and serendipity, where recommendations systems can play an important role in engaging consumers into a relationship with advertisers, meaning that advertising has the option to become an awareness service, a provider of tailored information. Salz stressed that a "universal search provider" can be compared to a "search hypermarket", where one finds everything but the product is not tailored, nor the search experience. On the other hand, filtering services are more like boutiques. In the boutique scenario, recommendation systems are one of the key assets. However, in the mobile domain, there is a need for more sophistication.

² A. Göker, HI Myrhaug, and R. Bierig. Context and information retrieval. In A. Göker and J. Davies, editors, Information Retrieval: Searching in the 21st Century. John Wiley and Sons, Ltd, Chichester, UK, 2009

Future Internet Public-Private Partnerships

Bernard Barani (DG INFSO, European Commission)

Following the keynote presentation and before the three sessions of short presentations, Bernard Barani of the EC presented the Future Internet in ICT Programme. He first outlined the general holistic approach towards a Future Internet combining very high rate mobile access, intelligent service capability, secure and trusted platforms, advanced (3D, immersive) media access and delivery, novel devices/sensors and related business processes. Barani then talked about the steps needed to move from research and development to innovation and the Future Internet Public Private Partnership (PPP) with a budget of 170M€ for the next WP. He discussed some of the Future Internet PPP mega trends and opportunities as shown below:



In the next part of his talk Barani presented the Future Internet (FI) PPP Framework, covering some of its most important aspects such as:

- Making use of multiple technologies
- Technology push + application pull
- Building up on multiple European R&D investments
- Building up on European Infrastructures investments.

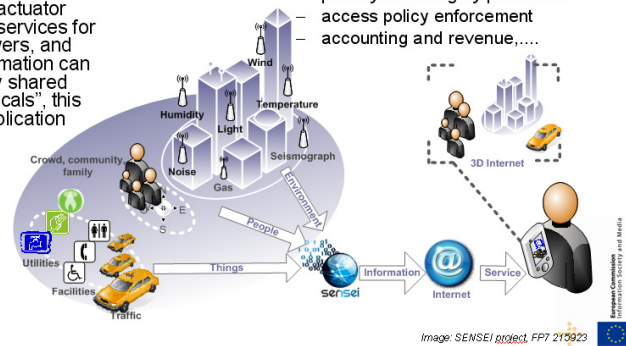
He also described some of the main characteristics of the FI PPP Core Platform:

- Generic, trusted, open platform
- Re-usable/composable in multiple usage contexts
- Generic enablers, key feature
- Open interfaces, API, SDK
- Multifaceted Industrial participation,

and the capabilities it has (would have): upgraded network; sensor networks coupled to the Internet; versatile service infrastructure; information access/processing; real-time applications; trust and identity; and ad-hoc aggregation of resources.

CP Sensor Aspect

- Common sensor and actuator information infrastructure across cities
 - provides secure and reliable access to sensor and actuator information services for multiple players, and so that information can be efficiently shared across “verticals”, this provides application enablement
- Sensor information enablement
 - aggregation and collection of data
 - directory services
 - data brokering and service composition
 - information federation
 - privacy and integrity protection
 - access policy enforcement
 - accounting and revenue,....



Barani concluded his presentation focusing on the mobile search relevant aspects of the FI PPP which according to him are:

- Huge amount of information from public sector “smart” applications, smart cities;
- Need To valorise this information;
- Right semantic environment: for information, for services;
- Openness and “unlimited” number of applications (app store);
- Mobility at the two ends of the chain;
- Orchestrating public data for the mobile user in open environments, complex queries.

Session 1: Socio-economic aspects of mobile search

Exploring the socio-economic logic of mobile search Jose-Luis Gomez Barroso (UNED)

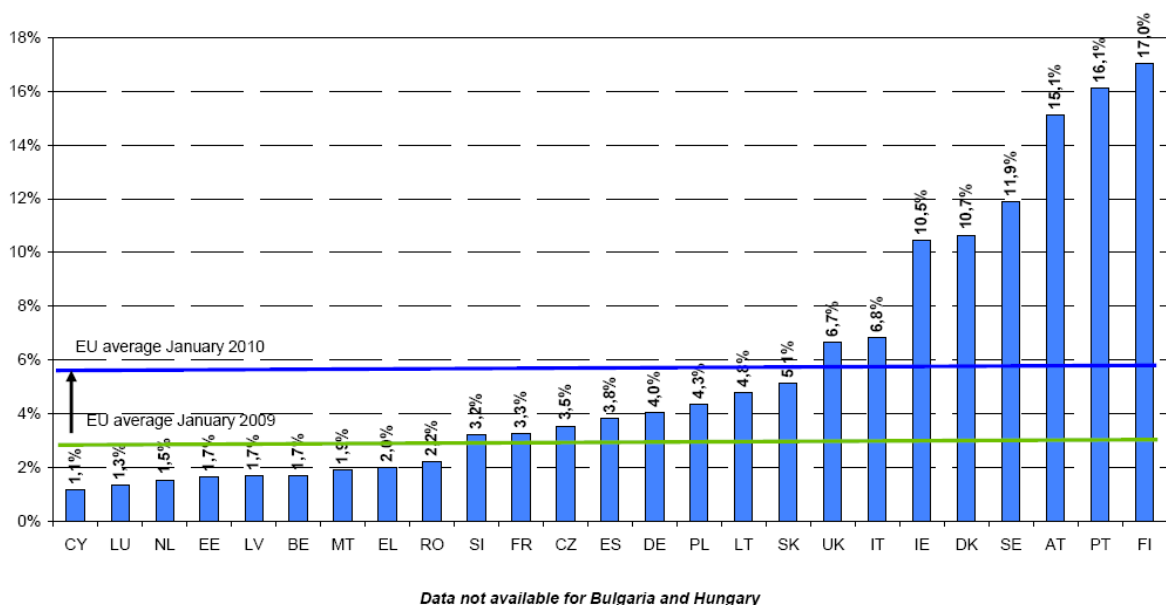
José Luis Gómez-Barroso is an Associate Professor in the Department of Applied Economics and Economic History at Universidad Nacional de Educación a Distancia (UNED), Spain. He holds a PhD and a degree in Economics. He also holds a degree in Telecommunication Engineering as well as another degree in Law. Recently, Dr. Gómez-Barroso has served as coordinator on a study on Mobile Search Future Prospects supported by the IPTS and whose results have been published by the Publications Office of the European Union ("Prospects of Mobile Search").

Gómez Barroso's talk started with one of the main findings of the "Prospects of Mobile Search" study he coordinated in 2009 for the IPTS. **The adoption of any technological application is dependant on technological maturity, economic feasibility and consumer acceptance.** His research has shown that technology is not the (major) barrier for the deployment of the mobile search applications. Therefore, the take up of mobile search is dependant on socio-economic logics that need further insight.

According to Gómez Barroso's economic feasibility is coupled with a number of environmental factors such as the availability and affordability of mobile broadband connections, the main enabler of mobile search, and the deployment of smart phones and their operation in 3G networks.

According to the 15th Progress Report on the Single European Electronic Communication Market³, the mobile broadband market is emerging rapidly responding to demand for ubiquitous internet access. The average penetration of dedicated mobile broadband cards is growing rapidly - the penetration rate in January 2010 being 5.2% compared with 2.8% in January 2009 (a growth rate of 86% in one year) as shown by the figure below:

**Mobile broadband penetration rate - dedicated data service
cards/modems/keys only, January 2010**

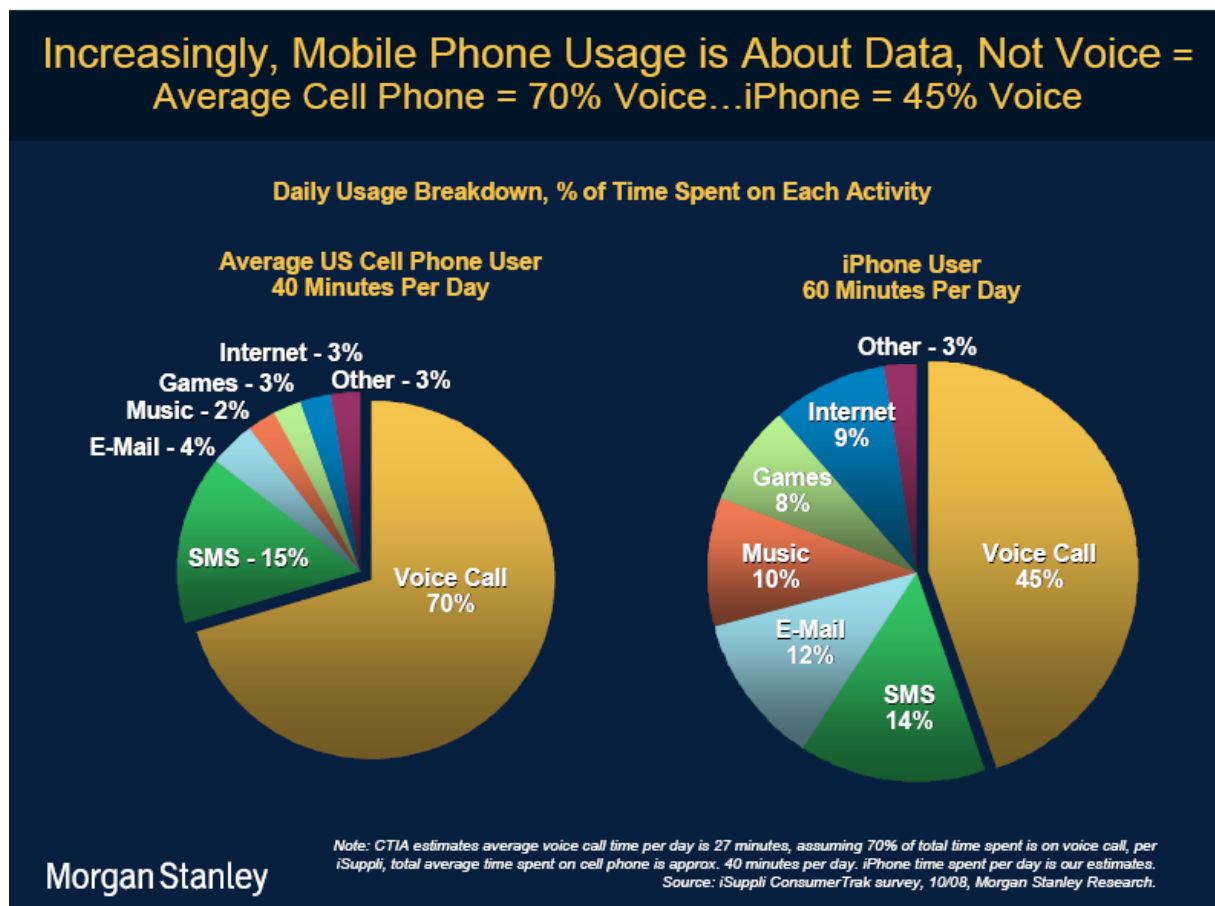


³ European Commission (2010). PROGRESS REPORT ON THE SINGLE EUROPEAN ELECTRONIC COMMUNICATIONS MARKET 2009 (15TH REPORT) (Communication from the Commission to the European Parliament, the Council the European Economic and Social Committee and the Committee of the Regions No. COM(2010)253 final). Bruxelles: European Commission.

In Finland, Portugal and Austria the penetration rate exceeds 15%. However mobile data services do not yet constitute a significant source of revenues, as shown by the table below (Source: EITO).

	Growth rate	Share in telecom service revenues
Fixed voice telephony and Internet access and services	-2.5%	36%
<i>fixed voice telephony</i>	-6.3%	24%
<i>internet access and services</i>	5.6%	12%
Mobile voice telephony and mobile data services	0.6%	47%
mobile voice telephony	-1.8%	36%
mobile data services	9.3%	11%
Business data services	0.6%	7%
Pay TV	11.7%	10%
Total Telecom Services (Carrier Services)	0%	100%

The take up of new smartphones and applications represent the second major driver for the adoption of mobile internet. Gómez Barroso referred to the Morgan Stanley's recent Mobile Internet Report⁴ and to the data reported below:

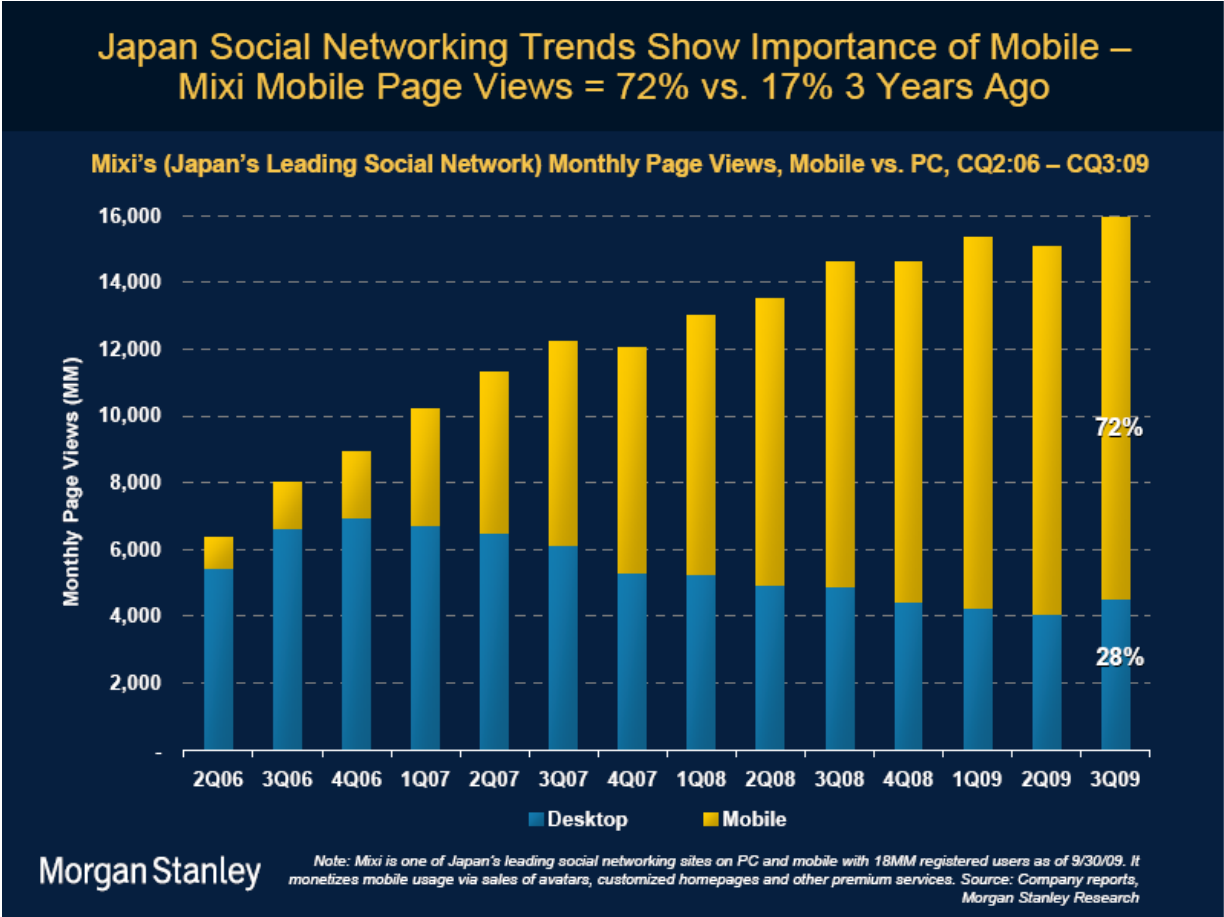


The slide above shows that the wide adoption of mobile application is possible, but not sufficiently deployed. The basic elements are in place and usage patterns are changing rapidly, even though not all of those who have internet-enabled devices use them as such.

⁴ Morgan & Stanley (2009). *The Mobile Internet Report. Ramping Faster than Desktop Internet, the Mobile Internet Will Be Bigger than Most Think*. Available at the following url: http://www.morganstanley.com/institutional/techresearch/pdfs/mobile_internet_report.pdf

The case of Apple’s mobile devices (iPhone and iTouch) shows that the simultaneous availability of broadband connection and smart devices is not sufficient. Apple is making the most out of a network of elements that are actually boosting the potential of the mobile Internet through the set up of an ecosystem that is made up of powerful mobile devices (iPhone and iTouch), an easy-to-use payment / distribution system (iTunes), and a developer-friendly environment for new applications (App Store). This creates a fertile soil for growth of mobile-specific Internet usage.

According to Gómez Barroso there is still a gap between the diffusion (potential usage) and the adoption (actual usage) of mobile internet services. However, trends show that this gap will diminish or even vanish (see the image below illustrating that almost three fourth of pages views of Mixi –Japan’s leading Social Network – were from mobile - already in the third quarter of 2009).



According to Morgan Stanley’s analysis, the mobile Internet investment cycle, will resemble the pattern of the desktop Internet, moving from infrastructure to platforms and then applications, services, and content (where we are today), followed by retail and commerce. If this is to be expected than the same logics should apply to the mobile search segment.

The future of mobile search is social Karen Church (Telefonica Research)

Karen Church is a researcher with Telefonica Research in Barcelona, Spain. She received her PhD in Computer Science entitled, "A Study of Mobile Internet Usage and Implications for Mobile Search Interfaces" from University College Dublin, Ireland in 2008. Karen's research interests include the mobile web and mobile search space, personalization and social connectedness in mobile settings, HCI and user interfaces. Karen's current research focus is on social mobile information access.

Karen Church's talk focused on the **specificity of mobile search**, and therefore on the opportunities that this specificity creates. According to Church, when talking about mobile search, some things that should be taken into account are:

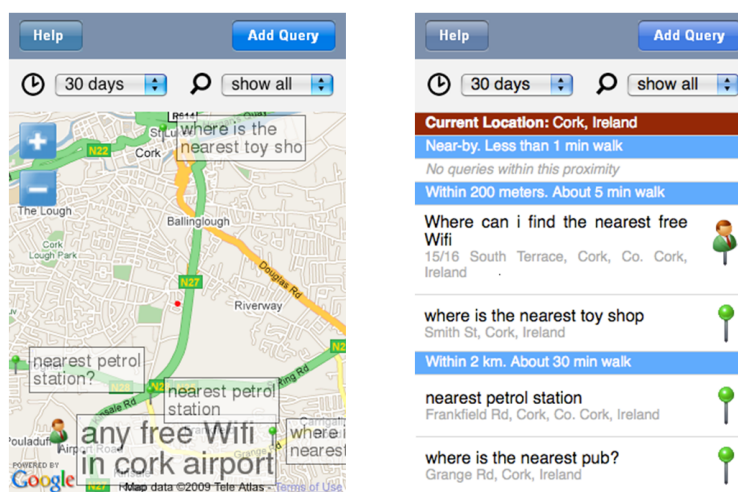
- Mobile devices are very personal devices;
- Mobile devices are used in a changing context, which dynamically shapes the user information needs;
- Mobile users tend to seek for "fresh" information;
- Mobile users are not to be studied in isolation, since their behaviour is highly social (the context that shapes their information needs is a social one, where the activities one is up to are important, as the people one is hanging out with or the time of the day).

Church argued that search engines are not always the best solution to find answer to spatially and temporally contextualised queries. Most often users' intent is best matched by others' capability to provide the right suggestions, advice, answer (If I wanted to know where was that cool bar in downtown Dublin, where I last met my friend Siobhan, I have better chances to get the right answer from Siobhan herself, rather than from any search engine).

Church introduced a project she is involved in with Telefónica R+D - the *Social Search Browser*: a proof-of-concept research prototype designed to enhance the search and information discovery experience of mobile users. The application proactively displays the queries and interactions of other users in a given physical location to provide an enriched sense of place. It encourages discovery of new, interesting content. It also incorporates social networking capabilities with key mobile contexts - allows friends to answer your queries while on the move. Finally, it taps into the social dimension of search and information access by allowing friends and other users to answer your queries while you are on the move.

The *Social Search Browser* has been designed as a scaffold for users to discover new content, to support curiosity, while at the same time enabling sharing of information and a help-oriented attitude.

SSB2: focus on interfaces for LBS



Church expressed a view that more work has to be carried out to:

- **Understand the nature of mobile information needs** and in particular to:
 - o understand exactly how important social is to mobile information needs (this would imply a better understanding of how to design opinion mining and reputation systems, but also to understand whether proactive systems would change the nature of information seeking from active and declarative search to a more erratic kind of behaviour, based on the exploration of nodes of a social network of information nodes);
- **Capture how mobile search behaviour evolves**
 - o Portal-based search and information access;
 - o Indicators of evolution: query variation, diversity, topics, etc.;
 - o Transaction log analysis;
 - o Live field studies
- Extend the *Social Search Browser 3* – **beyond a location-centred social search application**
 - o Design novel mobile search and mobile information access prototypes
 - o Utilize mobile social networks
 - o Research on future mobile search interfaces/interaction paradigms
 - o Understand the specificities of emerging markets.....

From location and social search to mixed reality Juha Kaario (Varaani Works)

Juha Kaario is a Head of Business Development at Varaani Works Oy, a start-up founded in 2010. Previously he was a Senior Business Development Manager at the Nokia Research Center. He joined Nokia Mobile Phones marketing department in 1995 and moved to Nokia Research in 1997. Prior to Nokia he has worked in the University of Tampere (1993-94), in the Technical Research Center of Finland (1992-93) and as a co-owner in a small company Medialoki Oy (1993-1996). His interests are in cross-discipline research for sustainable development, pervasive computing, social media and mobile services combined with business innovation. He is currently working in the Varaani Works Oy as a business developer and is the Chairman of the Board in another start-up, Newelo Oy.

Juha Kaario's talk started by questioning how reality can be augmented by electronic devices like mobiles. He brought as an example of emergent use of mobile phones, how children have transformed their seeking strategies while playing *hide and seek*, by calling the numbers of their friend so as to spot where they are hiding. His point was to stress that contemporary life is already augmented by the devices we are surrounded with, in a far deeper way than we are used to think.

Kaario continued by discussing the personal content life cycle as the information management framework where search is to be anchored. Such a lifecycle can be depicted in the following steps:

Get	Enjoy	Maintain	Share
Receive	Edit	Organize	Send
Create	Personalize	Archive	Print
Capture	Listen to	Backup	Publish
Pull	Remix	Trim	Give
Search	View	Protect	Show
Purchase	Read	Rate	Sell
Trade	Be amazed	Synchronize	Trade
	Recall		

Search maps on the above steps but can be further specified in terms of:

Personal Search: Photos, health, work...

Media Search: Music, videos...

Social Search: Recommendations, friends...

Local Search: Navigation, what's up...

General Search: What you ask is what you get..



When it comes to mobile search, context becomes a critical dimension since people look for different things if they are engaged in a domestic type of activity (home environment), in errands or social life activity (neighbourhood, commuting route), or in activities with a lesser degree of spatial connotation (looking for country news, searching for international service providers, or dealing with global content). On top of this distinction there is also an issue depending on the organisational context in which one is dealing with content. The opposition can be exemplified by juxtaposing *Home* and *Work* as two distinct organisational contexts. In the former case one normally deals with irrational needs, ad-hoc searches, unstructured data, privacy concerns, and an unsatisfied demand. In the latter case the needs are structured, planned, security driven, satisfied with VPN, sync, etc

Kaario reads the Cloud as a distributed repository for our personal content. The Cloud has become a delegate de facto to personal search (we use GoogleDocs to be able to access our documents at anytime, everywhere, the same we do with Flickr.com). According to Kaario, one's own content fits most context (especially in mobile settings), but it is seldom at reach. The challenge thus is to create a secure and continuous link to home and personal content so as to include the personal dimension fully into mobile search. Such a link would provide concrete steps towards a mixed reality environment where information enhances users experience, since it reflects the individual user's needs.

Session 2: Technologies and interfaces

Key differentiating technologies for mobile search

Michel Plu (Orange)

Michel Plu is a senior research engineer at Orange Labs. He has been working on information and content access services for more than 10 years. He received in 2000 the first France Telecom Innovation price. He has published several papers in different prestigious international conferences with one awarded as best paper at the WWW 2003 conference. More recently he has been the innovation director of the PHAROS European collaborative project dedicated to audiovisual search engines. His daily work is now a mix of conducting research on semantic technologies applied to information retrieval and managing development project for operational services on Orange web and mobile portals

Michel Plu began his talk by revising the technological bricks that are needed to build the future of mobile search:

	Technology	Keywords
Enabling technologies	Wireless networks	Broadband access ubiquity, dynamic spectrum management
	Sensor networks	RFID, Internet of Things
	Devices	Multimedia, location, interoperability, user friendliness
	Cloud computing	Web browser, Connectivity, security, data protection
Search technologies	Semantic and multimedia	Enriched Content Search
	Cognitive	Environment understanding
Specific mobile search technologies	Context awareness	Context acquisition and processing
	Augmented reality	Enriched content

His speech then focused on search-specific technologies and in particular **semantic search, context awareness and multimedia multimodal search**, which to him are the key technologies needed to move from retrieving a list of loosely connected results matching the input keyword, to an answer that is constructed to reply to a question by extracting information from available content.

He characterised semantic search in terms of the "universal one box search", where the user launches a query via a simple user interface (search box) to access all services.

Semantic search is based on a semantic interpretation of the query and the semantic description of services/content sources so that the query is routed to the appropriate service. It is mainly a text-based approach (either keyboard mediated or voice based) and one of the key issues is the textual query management, that is query spell checking, query completion, dealing with misspelled current typing, or with interface specific typing (SMS being different from PC text), but also query suggestions and expansion, speech-to-text conversions (even in noisy outdoor environment), etc.

Beyond the textual query management type of issues the true challenge has to do with the ambiguity of natural language, and word sense disambiguation (if I type in the word "Orange", am I looking for information about a piece of fruit, a city in France, a Telephone Operator, etc...?).

Semantic interpretation needs knowledge but it is becoming less and less expensive thanks to initiatives like linked open data or DBpedia (www.dbpedia.org) which are contributing to the description of semantic relationships among objects.

Part of the knowledge necessary to disambiguate the search intent of a user may come from the context, which can be defined indeed as any useful information to precise the query (space, time, user, device, history)

Plu took the query "Paris Brest" as an example. What does the user want to know about: an itinerary, a transportation offer, a French league football match or a cake?

This query can be disambiguated by mining a set of contextual data:

- An itinerary?
 - Brest is a good destination for summer holidays
 - Is the user currently on his way, has he planned some holidays?
- A transportation offer?
 - Does the user usually travel by plane, by train?
- A French League football match?
 - If the match is not finished - display the score
 - Can the user terminal play video? If not provide a textual summary
- A cake?

However mining the context is not a straightforward process and further research has to be carried out to understand what are the relevant bits of information that are necessary and sufficient to use to discriminate users' intent, motivation and search needs.

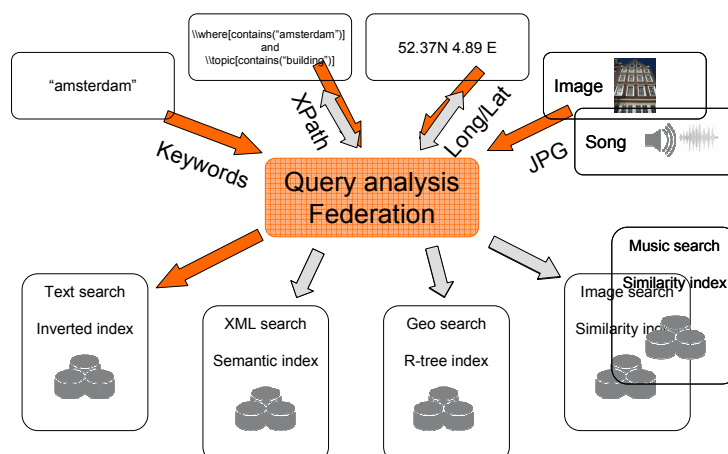
Issues relate to the modeling of users challenges relate to the availability (on the device, on the web, through the user community) of relevant information and the difficulty to interpret it and to use it (also for privacy and legal issues). Business rules also have a stake, once the context can be used to tailor the information, what is the role promotional information is going to play?

Plu expanded the technological discussion a step further, crossing the realm of textual query based search to include multimodal search, which is to include both multimedia search, and multimodal search type.

Multimedia search is about images (Flash codes, book/CD/DVD covers, news paper pages, movie posters) as well as sound (Music or Videos)

Multimodal search on the other hand allows submitting search queries not only as textual requests, but also through other media such as images and sounds (search by example), geographic position (LBS type of search, user profile (reality mining).

Plu presented the multimodal search architecture developed in the Pharos project, shown by the scheme below:



He made the point that on the one hand mobile search strengthens the constraints of multimedia search, because there is less choice to display and therefore better precision is needed. On the other hand, however, such constraints can be read as opportunities. Mobile search has the chance to become the leading search application driven by the need to shift from document search to information search and by the easier interaction with composite and multimodal content.

Seeking alternatives: multimodal, social and lazy mobile searching...

Matt Jones (University of Swansea)

Matt Jones is a Professor of Computer Science at the Future Interaction Technology Lab at Swansea University. He has worked on mobile interaction issues for the past fifteen years and has published a large number of articles in this area. He has had many collaborations and interactions with handset and service developers including IBM Research, Orange, Reuters, BT Cellnet and Adaptive Info. He has been a Visiting Fellow at Nokia Research and is currently a member of its Scientific Advisory Board (Tampere, Finland). He is an editor of the International Journal of Personal and Ubiquitous Computing and on the steering committee for the Mobile Human Computer Interaction conference series. Matt is the co-author of "Mobile Interaction Design", John Wiley & Sons Nov 2005. His research work has focussed on the fusion of physical and digital spaces in challenging contexts. Since returning to the UK from New Zealand in 2005, he has been involved in projects including ones to explore the role of haptics, gestures and audio in mobile scenarios and storytelling in rural Indian Village.

Matt Jones' talk challenged the mainstream approach to search, suggesting that humans look for information differently from the way machines retrieve information. His research is focused on understanding when and how people seek for answers, what they look for and how they make sense of different resources when mobile. Mainstream search is based on a (western-developed world) model of information seeking activities that reduces the human need to get answers to an immediate and discrete need that can be directly formulated in a text-based form.

Though this classical approach to search and information retrieval works in a desktop-based environment, it does not fulfill user's needs on the move.

When mobile, people are not always able or willing to act on an information need; nevertheless there is no system that supports users in getting back to their information needs at a later stage, when they are in a more comfortable situation to reflect on this information.

Most of the present effort is being devoted to the filtering of possible search results based on user's location. Location becomes the contextual aspects modeled to filter results of an information processing activity carried out by a search engine that is not built to mirror how human cognition works and how people make sense of reality.

According to Jones "context" is a porous concept that cannot be modeled to filter machine produced results: as a matter of fact, for human actors context is often an activator that triggers needs. Location does not account for the whole situation that triggers curiosity in the human mind.

Jones advocated for the exploration of alternative paradigms and suggested the following:

- Incidental search
- Delayed search
- Continuous and multimodal search
- Search targeted to the developing World.

Incidental search is Jones' alternative to location-based search, though it still addresses users' desires to find out more about the places they visit by means of their mobile devices. Referring to previous work⁵ he explained that the concept of incidental search springs from the idea of challenging the classical approach where the best matching answers to specific queries are sought. Rather here the idea is to provide the user with a spatially mapped layer of questions that other have posed in a specific location, so as to provide the users with a physically instantiated set of queries that maps other people's (prior) searches.

According to Jones, crowd-sourcing queries is a way to provide a flavour of the area (a sense of place), filling the need of the casual mobile search user that is not purposefully seeking for a specific bit of information, but rather is keen to be engaged in a playful exploration. Incidental search

⁵ Jones, M., Buchanan, G., Harper, R., and Xech, P. 2007. Questions not answers: a novel mobile search technique. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (San Jose, California, USA, April 28 -May 03, 2007). CHI '07. ACM, New York, NY, 155-158.

Arter, D., Buchanan, G., Jones, M., and Harper, R. 2007. Incidental information and mobile search. In Proceedings of the 9th international Conference on Human Computer interaction with Mobile Devices and Services (Singapore, September 09 -12, 2007). MobileHCI'07, vol. 309. ACM, New York, NY, 413-420.

(embodied in the so called "question(s) not answers" concept) is about extending the chances of the user to find interesting content by overcoming the borders of a direct query. Incidental search offers the user the chance to find something without intentionally looking for it, i.e. to explore the space via the cues that have been left as footprints by previous nomads, which make of that location an attractive place and not a simple collation of points of interest.

In sum, incidental search levers on the distillation of aspiration and values that make the "genius loci" and is not only made by the consolidated information associated to a given location but is rather reflected by the traces left by the human flows that pass through these geographic coordinates, as if they were dynamic snapshots of the changing dialogue people have with a place.

Incidental search requires minimal interaction and engages the users into exploration, and can thus be a complementary approach to classical search. Information visualisation and data privacy are the main challenges to be faced in developing further this concept.

Delayed search is a second alternative approach to information retrieval. Jones suggested that not all information needs are urgent. Many are cases in which our need for information seeking is triggered by an event, a situation, but such a need is not (meant) to be fulfilled on the spot. And it is not just a matter of "I will search for it later, since I cannot do it now" it is rather "I will search for it later, since I am currently engaged in another meaningful activity that I am not willing to disrupt by devoting my attention to an active information search". Jones claimed that at present users lack tools that trigger later stage search based on current needs. Systematic users note down the query to input it into a search engine at a more convenient time. However, it is likely that many search inspirations are not acted upon, because the query is not launched at the moment of inspiration.

Jones proposed to provide users with search facilities that do not constrain them to consume the results immediately, but rather support a two step process, where the launching of the query is detached from the consumption of the retrieved content.

He referred to the *Laid-back search* prototype⁶ he developed in 2003. The system was designed to support asynchronous search, both allowing the capturing of search needs in the background (i.e. by exploiting gestural interaction for quick "note taking" and using sensors data to derive implicit information for the refinement of the query) and supporting the analysis of the results of search in slower, more reflective ways than what we are becoming accustomed to with online search.

Jones argued that, as human beings, we need time to elaborate information - we do not process the world as machines do with strings of data. Furthermore, we survive because we are able to adjust to the external environment by using the most appropriate tools to mould it so as to improve our performance. This should lead to the reflection that trying to transform our mobile devices into a Swiss Army Knife might not be the best option.

Continuous and multimodal search is based on the merging/fusion of different type of technologies to provide the user with a continuous stream of information that remains at a peripheral level. The concept presented by Jones is based on iPaq, GPS, compass, audio beacons, and spatial audio and levers on music as a mediator of contextual information relating to the physical spaces we move through, providing continuous spatialised guidance for pedestrian navigation.

Continuous interaction is the alternative to the classical discrete, event-based style of interaction where the user is prompted by the system (in case of a mobile device it beeps or vibrates) and the user responds. In particular, it tries to overcome the limitation of mobile navigation systems that disrupt users experience, for instance when sight-seeing, by providing speech-based audio cues and small-screen maps that ask the user to look at the device while walking. The concept proposed makes use of music to help pedestrians reach their destination with a gentle peripheral guidance that blends with the wandering activity in a more pleasurable way.

Jones concluded his talk discussing developing countries, which are considered as the emerging market for mobile access to the Internet. He pointed out that large portions of the population in those areas are not literate, and subsequently will not be able to use text-based services. Finding novel interaction modalities to support these groups of people presents both a major challenge and a wild space for experimenting and developing innovative solutions⁷.

⁶ Matt Jones , George Buchanan , Tzu-Chiang Cheng , Preeti Jain, Changing the pace of search: Supporting "background" information seeking, Journal of the American Society for Information Science and Technology, v.57 n.6, p.838-842, April 2006

⁷ The IBM Spoken Web Project is the example cited by Jones information can be found at the following url: http://en.wikipedia.org/wiki/World_Wide_Telecom_Web

Discover, don't search Georg Treu (Aloqa)

Georg Treu is the technical founder of Aloqa. He got his PhD in Computer Science from LMU Munich and his MS from TU Munich. Georg has 30+ journal and conference publications and holds several patents in the location-based services (LBS) space. Before founding Aloqa, Georg worked in the financial industry developing highly scalable systems.

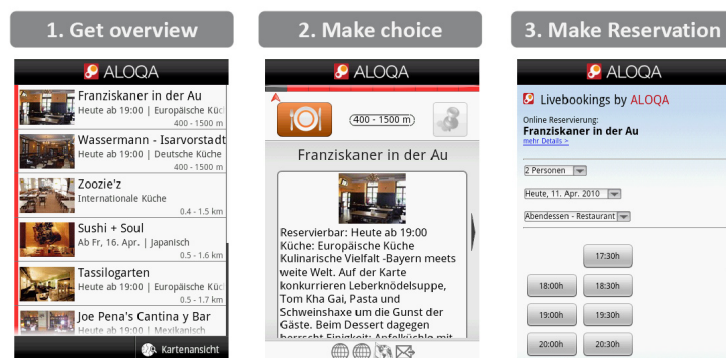
Georg Treu focused his presentation on the business and revenue model of Aloqa and its selling proposition. Aloqa is a Premium Service (not advertising, but billing based) that sorts through and proactively notifies users of relevant local content. It provides a platform where location-based service providers and users meet.

Aloqa proactively offers the user location relevant suggestions (aggregating the offer of different content and service providers⁸) by either notifying them intrusively (such as through an SMS) or non-intrusively, like a Blackberry email inbox that shows the number of unread emails. Aloqa's starting point is that mobile search, at least for what concerns LBS, is a not the most effective way to address users' needs of location relevant information. Indeed, unless the user has an urgent need (Where can I find the nearest chemist shop?) or an explicit navigational need (Which is the best way to reach the station from where I am?), it seldom happens that he/she will constantly scan the environment to see what's available in a given point in time and space (which would also be very inefficient in terms of battery use).

Real-time, push notification is Aloqa's solution to support the discovery of relevant content, a workaround explicit search actively triggered by the user in order to satisfy his/her intent. The user thus gets a customisable overview of what is available in their surroundings, makes a selection of the content he/she is interested in, and can then perform different transactions (e.g. making a reservation).

Being a platform Aloqa grants users privacy by representing a gatekeeper of users' data, that is without sharing user data with service providers and without constantly tracking the user.

Aloqa connects local vendors with their customers



More than simple search results!

Relevance of proposed content to the users is built by establishing correlation of social and contextual analytics and filtering, blending a Local Fingerprint (What's hot given the current context of the user's location) and a Personal Fingerprint built in a social network type of recommendation system (What's hot with sharing the same interest of the subscriber given his/her location).

⁸ At the time of the presentation Aloqa matches the offer of more than 200 publisher with 750.000 potential users, the number referring to how many times Aloqa's API has been downloaded. Examples of content and services that are aggregated on Aloqa include: Popular Places (Yelp, Starbucks, Wozzon, Livebookings, meetup, Qype), events (Nachtagenten, Popula, Eventful, last.fm...), bargains (Coupons.com, Coupies, DeutschlandCoupon,...), transportation (Call-a-Bike, MVV,...), accommodation & Singles (hotpads, match.com,...), points of Interest (wikipedia, nextstop,...)

Next in mobile search: recommended web standards close by *François Daoust (W3C)*

Before December 2007, François helped develop an on-portal mobile search engine called MotionBridge from its first minimalist draft within a small French start-up to a full-featured version within Microsoft. This kept him busy for more than seven years. Then he joined the W3C where he learned the theory behind the great Web, and now happily tries to conciliate theory and practice within the Mobile Web Initiative. He maintains the online W3C mobileOK Checker, contributes as a tutor to the online training sessions on Mobile Web Best Practices and serves as Staff Contact for the Mobile Web Best Practices Working Group.

François Daoust's talk focused on the open issues characterising the mobile search domain and contrasted them with those aspects that are close to being standardised.

His first point was that context-awareness is the key feature that might enable disruptive mobile search applications, though he claimed that it is difficult to define context awareness. Mobile context emerges from the combination of several very different aspects: geolocation, i.e. where the user is (through GPS, triangulation, set by user); what the user sees or hears; what the user is (age, gender, height, weight, job, income, ...); what the user has (car, computer, music, purchases, ...); what the user knows (studies, known movies, music); what the user likes (sports, hobbies, blog posts, comments); whom the users spends his time with (family, friends, colleagues); plus history for each of the above.

All of the above information is quite personal to the user and services that build on it are privacy intrusive. User's privacy is progressively being eroded by emerging digital services, services that create and store digital records of people's movements, behaviours and transactions. Daoust referred to extreme cases like Blippy.com ("a fun, free and safe site that lets you share your purchases and see what your friends are buying online and in real life. Blippy lets you communicate about and share purchases with friends by syncing already existing e-commerce accounts to Blippy such as iTunes, Netflix, Woot, eBay and more") or Internet connected body scales (allowing users sharing they weight data like Withings.com) or service that allow users to publish their voicemail (<http://audioo.com/>) as well as awareness-raising campaigns like Pleaserohme.com and the work done by the Electronic Frontier Foundation.



Daoust pointed to the work that is being carried out at W3C level, which touches upon some of these issues. For example, he mentioned the **Device APIs and Policy Working Group** (<http://www.w3.org/2009/dap/>).

Next possible standards may relate to:

- Media ontology
- Delivery Context Ontology
- *Memento* to add time to the Web
- Metadata format for Web applications to ease discovery
- Attention Profile Markup Language (APML)
- Augmented Reality Markup Language (ARML)
- More device APIs (e.g. speech input tag)
- Interactions with social networks
- Best practices to write context-aware mobile Web content
- Speech synthesis
- Gestures.

Session 3: Services, applications and business models

Mobile search in a touch-centred world Steve Ives (Taptu)

Steve Ives is founder and CEO of Taptu Ltd, a mobile search company based in Cambridge, UK and Denver, USA. Previously he was founder and CEO of Trigenix, a Cambridge-based mobile software company which was acquired in 2004 by Qualcomm Inc. He worked for Qualcomm Europe as VP Business Development until mid-2005. Steve graduated in Biochemistry from Cambridge University, holds an MBA from the Wharton School at the University of Pennsylvania, and was elected a Fellow of the Royal Society of Arts in London. He also serves as non-executive Chairman and director of Teamstudio Inc, a software tools company based in Boston, USA. Trigenix won the 2003 GSMA Award for Best Wireless Application Developer, and the 2003 Sunday Times Fasttrack 100 Award for Best Management Team. Taptu has also received several industry awards, most recently the 2010 Meffys award for Best Content Discovery and Personalisation Service.

Steve Ives's talk focused on the market of touch screen phones and devices, i.e. devices that look more or less like the Apple iPhone – 3 inch touch-sensitive screen, high quality browser, usually bundled with some kind of mobile internet tariff – and related devices like the iPod touch which operate on WiFi networks only and which can run most of the same apps and services.

He presented data showing that, despite the global recession, shipments are growing fast, and 45% of all phones that ship in the US, and nearly 50% of the phones that ship in Western Europe will be touch screens in 2010, up from just 16% in 2008 and predicted by Gartner to hit more than 80% by 2013.

The iPhone has represented an important driver, but Android is growing and low-cost touch screen phones are coming into the market this year. By the end of 2012 the installed base of touch-screen phones is predicted to climb to more than 1 billion units.

Taptu estimates that touch screen phone users search five to ten more frequently than non-touch mobile phone users. Data show that with the rise in touch screen phones, there has been a massive expansion in the quantity and quality of made-for-touch screen content. By the end of 2009, the number of iPhone apps had reached around 135,000 apps in the App Store, Android had reached about 20,000 in the Android market, and the total count of mobile touch sites had grown to more than 300,000, with growth rate in touch content between 200% and 300% a year.







It all started with games but it is rapidly shifting towards the Touch Web (326,000 touch sites and Web Apps as measured by Taptu at the end of 2009, as shown in the slide reported besides).

The biggest category of the Touch Web is Shopping and Services – just over 20% of the total, followed by News & Weather (8% of the sites).

It is in Shopping and Services that the greatest monetization can be expected.

Ives believes that this trend will definitely shape the mobile search market and Taptu bets on “Touch-Friendly Search”, a mobile search experience optimised for touch devices.

comparison of app store and mobile touch web

	% of total	App Store	Mobile Touch Web
 Games		18.0	0.9
 Entertainment		14.4	2.2
 Sport		3.7	1.2
 Shopping & services***		3.6	20.3
 Music		3.3	1.5
 Social		1.7	11.6

Sources: *App Store data taken from Mobilix, Jan 17th 2010

*** Data calculated from Business and Finance categories in App Store

Taptu's “Touch-Friendly Search” is built around the provision of:

- › *Specific indexes of touch phone friendly pages and content, differentiating touch phone friendly pages from the surrounding universe of desktop Web pages.*

- › *New ranking algorithms giving results that are truly relevant to the touch phone user, so that users are taken to the best results for their phone, not just the best results matching the keyword to the topic.*
- › *A new style of user experience for search that exploits the user interface capabilities of touch phones and fits in with the more relaxed and playful “sofa search” mindset of future touch phone users.*
- › *More entertaining and engaging ad formats with the potential to monetise significantly better than today’s mobile search ads.*

Taptu's White Paper "Exploring the Touch-Friendly Web", 3rd Ed, 2009

At <http://taptu.com/metrics/> the reader can find Taptu reports addressing:

- › The ecosystem – January 2010
- › Shopping & Services update – February 2010
- › Government and Non-Profit update – March 2010
- › State of the Mobile Touch Web quarterly update – April 2010.

Multimedia search for the mobile web

Pierre Scokaert (ABphone)

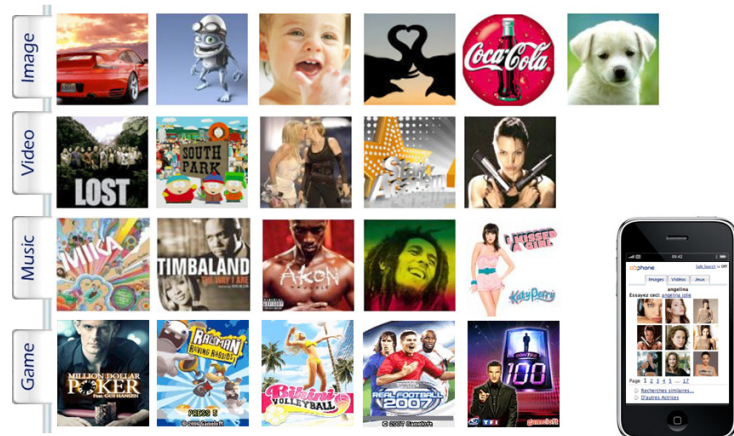
Pierre Scokaert was born in Belgium in 1968. He studied in the UK and obtained a degree in Engineering from Oxford University in 1994. Since then he has worked in the software and mobile services industry, holding positions in the US and France. In 2000, he created Opensugar, a company specialized in the commercialization of mobile web services for operator portals. In 2005, he created ABphone, a multimedia search engine specifically designed for mobile users. In 2010, he created Airbuzz, a company that helps independent artists market their music on mobile phones.

Pierre Scokaert's presentation was focused on the ABphone: a search service designed specifically for the mobile web. ABphone is optimized for vertical search in entertainment channels (images, videos, games, music, news...). ABphone automatically detects the connecting handset and tailors the layout of results so as to ensure that they are optimally displayed on the user's mobile phone. Scokaert argued that the specificity of mobile access to content does not only depend on screen size and bandwidth limitation, but it is rather related to how people use their mobile devices for Web navigation.

Becoming a Multimedia Store



- ... extended in 2009...



abphone © June 2010

"The mobile phone is often used to fill idle time. It is always on, close at hand, and it offers various ways to pass time (while waiting for a bus, for instance). One thing users do increasingly, in those spare moments, is to browse the mobile web, which provides them with a perfect source of distraction and entertainment, ideally suited to fill those few minutes. Browsing sessions are generally short and end suddenly. It is therefore key that value (entertainment typically) is provided immediately to the user, so that even the shortest sessions are experienced as positive. This is a typical example of the five-minute web, a web of instant gratification, where content must be found and accessed in minutes or seconds".

ABphone whitepaper "SNACKING THE WEB"⁹

Fast consumption is a distinctive feature of mobile compared to PC browsing, which makes of the mobile a "snacking" device. The assumption that mobile users prefer having snacks on their handheld devices (rather than five course meals) leads to a re-thinking of mobile search (and content). On a mobile device, search passes from an intent-based activity to a casual, recreational pastime. ABphone's vertical search service has been designed to match the users' desire for snacking the web.

⁹ available at <http://www.abphone.com/web/pdf/SnackingTheWeb.pdf>

Searching, finding, navigating with the Wikitude ecosystem *Philipp Breuss-Schneeweis (Mobilizy)*

Philipp Breuss-Schneeweis is the founder of Mobilizy, an Austrian-based startup focusing on location-based services and Augmented Reality. The company's flagship product is Wikitude, an Augmented Reality browser. Point of interests can be searched by current position and viewed on a map, list, and on an Augmented Reality (AR) camera view. Wikitude is available for Android, iPhone, and Nokia 5th edition and 3rd edition phones. Latest addition to the Wikitude product suite is Wikitude Drive, worlds first mobile Augmented Reality navigation system with global coverage. Wikitude has won the Grand Prize at the Navteq Challenge 2010 (Mobile World Congress, Barcelona).

Philipp Breuss-Schneeweis focused his talk on Augmented Reality (AR) and in particular on Wikitude - an AR browser developed by Mobilizy. Breuss-Schneeweis defined AR as the result of merging the physical real-world environment with virtual computer-generated imagery, creating in this way a mixed reality. This concept was demonstrated showing a video¹⁰ of Wikitude Drive, Mobilizy's mobile AR navigation system (for Android 1.6 and above). The system works by attaching a mobile phone on top of the car dash board looking at the road. The application then overlays driving instructions onto the video captured through the camera of the mobile phone. This allows users to drive watching the road while they are looking at directions. Instead of looking at an abstract map (as one would do on a normal GPS) the user can keep looking at the real world.

The AR approach of Wikitude Drive has the advantage of allowing the users to look at the indications without taking his/her eyes off the road, which is one of the main safety drawbacks of normal navigational systems. A future version of Wikitude Drive will integrate the possibility to detect Points of Interests to leverage the full power of the Internet as well as of user generated content - Mobilizy has launched a competition to crowd-source the development of AR Worlds that will enrich the service by providing thematic layers of information
<http://www.wikitude.org/worldcup>.



¹⁰ The video can be watched here: <http://vimeo.com/user2410256>

Workshop and Think-Tank Roundtable discussion

The workshop concluded with a round table discussion aimed to find out whether there is consensus amongst experts about Mobile Search future trends and directions. This roundtable panel discussion was also organised as a Think Tank on Mobile Search (again within the Chorus+ project) with a particular emphasis on technological future trends and directions in mobile search¹¹.

A panel of all previous workshop speakers plus Philippe Cheron of YACAST took part in a lively discussion, chaired by Stavri Nikolov (IPTS) and Pieter van der Linden (Technicolor).

To achieve the above-mentioned aims, the discussion was centred on the following key questions:

- How are mobile information needs changing?
- How are mobile search usage patterns changing?
- What are the main technological and economical challenges ahead?
- Which are the major bottlenecks?
- How is the mobile search market likely to evolve?
- How is Europe placed with regard to the rest of the world?

The discussion was structured by the presentation of the preliminary results of an online survey designed by IPTS to gather experts' views on techno-economic trends and social aspects of mobile search, which are likely to shape the future of this sector. The survey was conducted in April/May 2010. 150 experts in the mobile search field received an invitation to participate. 54 actually completed the questionnaire. Preliminary findings were briefly presented by Margherita Bacigalupo of IPTS during the roundtable discussion to stimulate reaction and debate on different technological and techno-economic aspects of mobile search so as to gather participants' views on the above-listed questions. The discussion covered several areas related to parts of the survey and the main issues are summarised below.

Mobile Search: what is it about?

The panel started debating the specificity of mobile search. There was consensus concerning the fact that the mobile device (at least in the developed world) is felt by its user as the most personal and confidential piece of technology. Beyond being the most personal device, the mobile is also always on and always with the user. The specificity of mobile devices and therefore of mobile service fruition, however, is not determined only by the features of handheld devices. Such devices are different from PCs because they are always with us and always connected, however their peculiarity is rooted in the dynamic way in which they are used, i.e. across activities. Mobile devices can be used both in a rush, while commuting, as well as to fill idle time say while in a queue and comfortably sitting on a sofa at home. It is critical to avoid reducing the specificity of mobiles to be "on the move". It is not a matter of displacement but rather an issue of seamless transition across contexts and activities.

It was also pointed out during the discussion that once the only mobile devices were phones while this has now changed with netbooks and tablets such as the iPad having entered the category of mobile devices and enlarging the scope of possible mobile uses.

The take-away message was that the distinctiveness of mobile use is hard to model, therefore, a generic definition of what *mobile specific* is cannot be given, without the risk of being reductionist. The challenge is to be able to define the emergent properties of a complex system of interactions mediated by mobile devices.

Focusing search specificity on mobile use, it was agreed that on the one hand search on handheld devices is affected by a number of hardware constraints (e.g. screen size or information input aspects), while on the other hand it offers context-related advantages (e.g. handheld devices can be geo-located).

Round Table participants did not reach a consensus on what are the key aspects of search through mobile devices. Some stressed that the ability to search for locally relevant information (weather, news,

¹¹ The Think Tank minutes are available on the CHORUS+ project website at [http://www.ist-chorus.org/public/files/Chorus+%20TT1_notes_WP5_June2010_V1_0\(2\).pdf](http://www.ist-chorus.org/public/files/Chorus+%20TT1_notes_WP5_June2010_V1_0(2).pdf)

traffic) represents the most distinctive aspect of mobile search. Others argued that there is evidence¹² that there is no significant difference in the percentage of local search on the iPhone and on PCs. Some mentioned that mobile search is about "fresh" content; others claimed that mobile users search for snacks of content, or for very concrete results. While some experts claimed that socially enhanced search is the real asset, others argued that, the mobile being the remote control of our lives, mobile search is much more about finding personal content.

Some of the participants challenged the discussion by asserting that the mobile should be considered as a new media platform using its own content ecosystem, requiring a completely different approach to search.

As the discussion proceeded it became clear that there is no consensus on how to map the mobile search geography. The differences in opinion suggest that we are still focusing on the individual pieces of the puzzle, far from being able to sketch the/any overall picture.

It was observed that one of the reasons for the co-existence of so many different view points can be unveiled looking at a historical perspective. The mobile web builds on the legacy of the "walled garden" characterisation of mobile telecommunication. Mobile Network Operators (MNO), content aggregators like Apps Stores, iTunes, ABphone and Taptu are shaping access to content based on a Portal Model with associated revenue models. It was also pointed out the Mobile Internet (and search subsequently) suffers from restrictions imposed by MNOs exerting bandwidth control on highly popular video sites, or turning off Voice over IP, or imposing unaffordable roaming costs. The landscape is scattered because the Mobile Web is not open yet. The **network neutrality** debate is limited to broadband connection, but there is an urgent need to have the debate extends to wireless networks too.

Technology¹³: is it a bottleneck?

According to the findings of the 2010 IPTS survey the main technological bricks enabling mobile search are considered already available. However, to half of the questionnaire respondents the main challenge for the full deployment of mobile search services is still of technological nature. Panellists stressed that user tracking for geo-positioning is not sufficiently fine-grained for optimal service fruition. Similarly gesture based interfaces are not robust enough to sustain interaction in real-world environment, further they are not as "natural" as they have been praised to be. In addition, voice interfaces are also under-performing, with respect to the required level. Voice is considered to be the main input for the future of mobile search, being the interface for illiterate users. Nevertheless on the one hand voice recognition accuracy is not increasing; on the other hand voice-based interfaces are often disappointing from a user-experience point of view. When using voice, users expect to be engaged in a conversation, not to be providing instruction or be selecting among 7+/-2 options. Siri.com was cited as an example of overcoming this limitation.

It was also mentioned that the absence of Europe-wide ubiquitous Wi-Fi infrastructure is also a barrier to the deployment of mobile services.

The round table participants agreed that the future of search is likely to be shaped by the capability to levers on the social aspects of both mobile communication and users behaviours. Reality Mining (<http://reality.media.mit.edu/>) and the possibility to collect machine-sensed environmental data pertaining to human social behaviour were mentioned as options, together with the ability to harness the social capital embodied in users' social networks.

Privacy: does it constitute a barrier for the development of mobile search services?

From discussing social search from a technological standpoint, the debate flitted to the privacy harbour. Mobile search is successful in as much the provided results are relevant to the individual

¹² Kamvar, M., Kellar, M., Patel, R., and Xu, Y. 2009. Computers and iPhones and mobile phones, oh my!: a logs-based comparison of search users on different devices. In Proceedings of the 18th International Conference on World Wide Web (Madrid, Spain, April 20 - 24, 2009). WWW '09. ACM, New York, NY, 801-810.

¹³ The technological evolution of mobile search and the major developments experts expect to happen in the future are covered in the Think Tank 1 Meeting Notes (Chorus+ Deliverable D5.2.1).

users. Relevance is not an abstract factor, it is relative to the user himself/herself. It thus requires knowing who the users are, at least in terms of where s/he is and what are her/his likings.

Given that relevance is individual-specific, personal data gathering is crucial to provide filtered results that are relevant to the individual. This statement triggered a lively discussion on privacy.

Some of the panellists argued that users' attitudes towards privacy are rapidly evolving. It was mentioned that to the digital natives the core of privacy lays in being able to prevent parental intrusion into their SNS' profile. Other panellists claimed that were youngsters fully conscious of the dangers associated to privacy-invasive technologies, they would take proactive actions in protecting their personal information. Some argued that consumers are becoming more aware of the risk of over-disclosing personal information, noting that there is a trend advocating for design solution that embed privacy as a value. Filtering of results, for instance, could be performed at the level of the user's device, or looking for solutions that simplify users' lives. Some of the participants claimed that users would be paying for privacy preserving technologies if these were effective and easy to use.

Though the availability of personal information for service provision and the related privacy concerns were considered as one of the critical issues for the deployment of mobile search, the panel did not converge to a consensual formulation of the problem and its implication. No consensus was achieved on possible mitigation actions, though a regulatory approach on users' behaviour was deemed unlikely to be effective since "there is not much you can do against people disclosing their information" as a participant claimed.

Search Service: how can value be monetised?

According to the 2010 IPTS survey the majority of experts filling out the online questionnaire identify the major challenges for Mobile Search to be in the economics arena.

This statement was used to launch discussion on business and revenue models in the domain of Mobile Search.

The panel was unanimous in saying that one of the main bottlenecks for the development of EU search market is represented by the absence of data flat rates and data roaming flat rates (or at least of predictable rates). Services are not going to spring and flourish until the take up of the Mobile Internet is promoted at access level. Participants commented that this respect the promotion of WiFi hotspots could make up a driver which is not fully exploited at present.

The panel agreed that disruptive business models have not broken through yet.

Some of the panellists mentioned that an evolution is to be expected in marketing promotion strategies: advertising is a concept that does not fit today's media. Advertising is the model that makes the most out of broadcasting communication channels. Mobile networks enable narrowcasting, potentially reaching the level of one-to-one marketing, allowing for a customised mix. Today's technology enables a paradigm shift in product/service promotion leading to a model where customer engagement is the main key to success. However solutions have to be tailored to the type of service as well as to the target audience. It is unlikely that a single winning revenue model will emerge fittings all business models.