Context Perspectives for Scenarios and Research Development in Mobile Systems

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DRAFT of Chapter 9 in Wireless World: Mobiles - Past, Present and Future, edited by Lasen and Hamill , Springer-Verlag, 2005

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Keywords: design, mobile, scenarios, development, interdisciplinary, users, place, STS, socio-technical, context

1. Introduction

There is a huge amount of technical research and business investment in wireless and mobile technology that could be the basis of future systems available to the public. The current generation of mass-market technology primarily supports one-to-one voice calls and simple messaging. Newer technologies such as WLAN (Wireless Local Area Networks), and 3G (Third Generation) cellular systems most notably, offer the capability of many more services, from Mobile Internet through video messaging to wireless gaming. Mobile digital television and picture enhanced radio is set to become available in some form by 2006. Departing from the traditional mobile phone, the number of devices that can be used wirelessly is also the subject of considerable innovation – with PDAs (Personal Digital Organisers), smart phones, tablet computers, wireless game terminals, plus many "fixed" devices. However, there are still many uncertainties about who the users might be, how and where these services may be used, what infrastructures and technologies will be built to provide them, and who will make profits.

This chapter is based on work undertaken as part of a technical research project, FLOWS (Flexible Convergence of Wireless Standards and Services), aimed at creating a sophisticated technical integration of a range of wireless systems on a single terminal. The engineers needed models and scenarios for use of this technology that are based on research on existing use of mobile telephones, computers and other ICTs, and visions of future use. A method was developed to make existing social science research relevant to the engineers, and in the process develop a framework for imagining future users, patterns of use and appropriation, and directing user research. It proposes some key insights into the development and use of scenarios in this process, highlighting weaknesses in existing scenario development.

"Integration" terminals form an essential part of the vision of convergent network systems that is very powerful within the telecommunications and IT industries. Interoperability between different networks and radio systems – Radio or Wireless Local Area Network (WLAN), UMTS (Universal Mobile Telephony Standard), DVB (Digital Video Broadcasting), fixed wireless and 4th generation radio access networks being the dominant – is seen as a way of exploiting the different characteristics of each technology: their bandwidth, mobility characteristics, quality of service, coverage etc. All communication and ""content" could potentially be carried over all radio access networks with an IP (Internet Protocol) core network using common protocols. Full network interconnection on the model of GSM (General System for Mobiles) and the Internet should bring huge benefits from "network externalities". "Integration" terminals that can connect to several different radio networks are a fundamental part of a number of

technical visions, such as “always best connected” when the most appropriate connection is chosen depending on availability, price and use, or simultaneous use, the FLOWS concept, where several radio networks are used at the same time.

However, it is not just a matter of technical possibilities. This convergence could be used in the realisation of two dominant industry visions or poles of attraction: the “mobile internet” vision and the “rich voice” wireless world vision, one being driven by the IT industry (predominantly US-centred) and the other, the mobile telephony industry (European and Japan) respectively (Stewart et al., 2003, Lehr and McKnight, 2002). Competitive pressures and alternative visions are shaping future wireless, and present many technical and commercial challenges to convergence. For example, ther e is considerable resistance among operators to creating one terminal that will provide mobile telephony using licenced spectrum, and an internet connection using licenced-exempt bands on the other. This represents a struggle between operators, vendors, content service providers or software platform firms to control, configure and brand the terminal. The challenge is all the more difficult given a climate of uncertainty over what people might actually want to pay for, corporate debt, increased competition, changes in spectrum regulation, new technologies, and a general desire by corporate and mass market customers to control, if not reduce, costs.

This chapter is primarily about developing tools to use social science research as inputs to specific scenarios that engineers will use to test and design a specific technical configuration. In the case given as an example, this configuration assumes a range of WLAN, UMTS and GSM services which will be available under particular physical, user and business circumstances. The scenarios must therefore imagine a world not too different to today’s in which we are expected to have and to use a greater range of wireless connected devices and services, and highlight everyday situations that would test this technology in various ways.

2. Some Definitions

Communication in cross-disciplinary research is hindered by different terminologies amongst various specialist groups, particularly where the same term (especially service, application, scenario and user) has different meanings for different groups. There is no immediate prospect of aligning these usages, which are deeply embedded within the expert communities such as telecommunications engineers, computer scientists, social scientists. In an attempt to aid clarity and communication in the FLOWS project, a number of more specific terms were developed and defined. The definitions are not intended to be exhaustive, and are presented to offer some consistency in an area beset by very broad and often competing uses of the terminology. Of particular difficulty, as the UMTS Forum (2002) points out and fails fully to deal with, are the terms “service” and “application”, which are explored in more depth, and redefined.

Instead of the generic term “service”, which can mean anything provided by one party to another according to a contract, the FLOWS project used the term Network Service, a telecommunications transmission facility optimised for particular Data Applications, such as speech telephony, asynchronous data transfer etc, but not limited to those uses (eg analogue speech telephony services can also be used for data transmission). These can be provided over a range of bearer systems, such as GSM or 3G mobile network, a local wireless network or digital broadcasting, with some systems being more appropriate than others. The term Service Product is used to describe a combination of these that can be sold to end users or resellers. For example, mobile intranet access for laptops is currently being sold in a product that uses WLAN, GSM and 3G to provide data-only access. Some phones can switch between local wireless and a mobile system, and still provide voice calling and text messaging.

Further, three terms were coined related to the idea of “application: Application Domain, Application Package and Data Application. These definitions make it easier to distinguish what is being discussed, and link user and market based definitions to technical definitions.

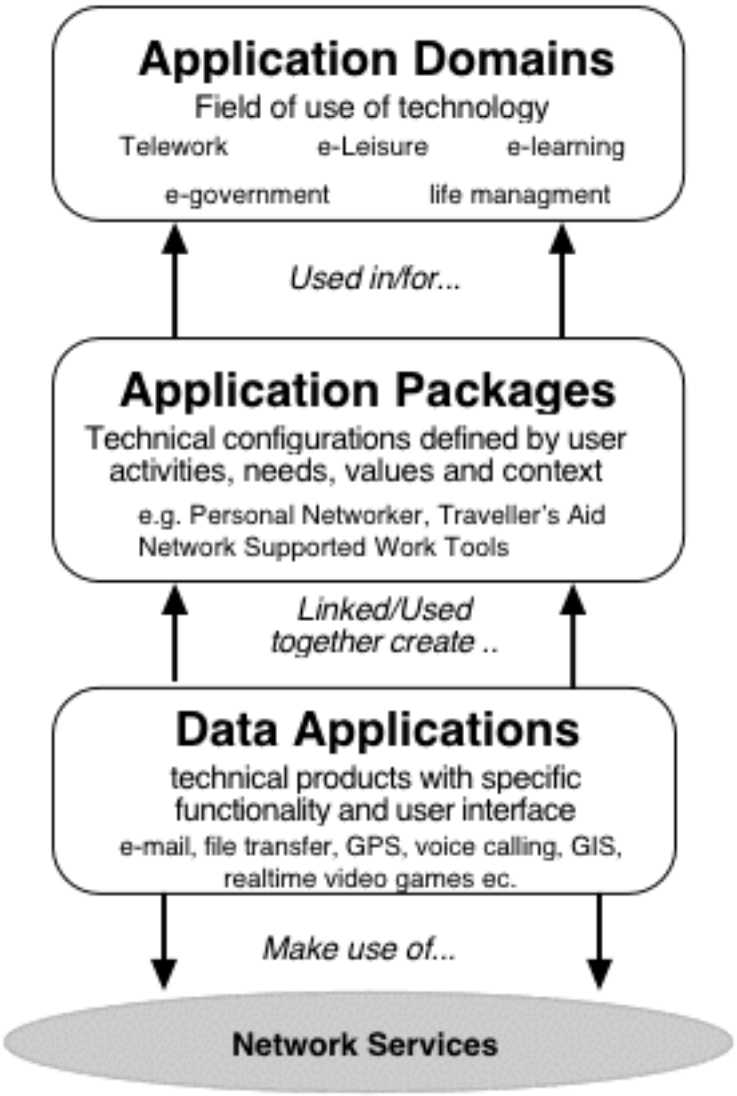

Figure 1 Defintions of "Application"

2.1 Application Domains

The term Application Domain links a domain of activities such as education and learning, shopping/retail, leisure, community participation (the "what"), with the enabling technologies or processes that is the "how" (for instance "e-", "tele-"), creating applications such as "e-learning". Applications understood in this sense then follow those presented in the EC IST Beyond 3G Cluster Report ("Beyond 3G Project Cluster", 2002). In creating analyses and scenarios of business and use, the general term "application" is used to refer to what people are using the technology for. The classes of application referred to in this case depend on the type of analysis being made; for example, they can be grouped according to functional activities or market sector — e-learning, teleworking, e-leisure — or according to cognitive and social use — belonging, control, intimacy etc.

2.2 Data Applications

Data Applications are specific data or information handling applications based on use of computing and communication services, the use of the term application commonly used to refer to computer programs used by end users. Data Applications have a narrow function or

specification, both from technical and end-user points of view, but are used to support a range of user activities: email can be used for e-commerce or tele-education. A Data Application is a combination of software and hardware that directly interacts with a user, and are thus defined from a user point of view and a data processing perspective. Their description is essentially functional. Familiar Data Applications include e-mail, word processing, FTP, web browsing, short messaging, voice telephony, P2P messaging, GPS, video on-demand etc. There are many more specialist Data Applications designed for particular industries, including mobile surveillance, urban guidance, tourist guides, parcel tracking, etc. (Velez and Correia, 2001). These Data Applications generate particular demands on service infrastructure, utilising one or more types of network services.

Network Data Applications generally require technology installed in the users' device and that of their correspondent in the case of telephony, or application service provider (eg e-mail accounts, on-line banking, file server). In telephony and Internet provision, the network service providers generally provide only basic additional applications, such as voice mail or e-mail (and SMS) servers. All other applications are accessed on third party providers' technology, using the user's device.

The Data Applications that we are familiar with are being reshaped in meaning over time and with technical changes. For example, e-mail can be implemented in different ways, and to the end user, appear to merge with multimedia messaging. A web browser can be used to read e-mail, and the sending and downloading of larger and larger attachments means that it is as much about large file transfer as short message reading. Many specialist applications are increasingly based on the combinations of a limited set of "standard" Data Applications (Williams et al., 2005) using common standards. The way Data Application is defined is very much related to current practice and available technology. As these change our perception of basic data functions changes too. What is at one time a peripheral Data Application, seen as subsection of another application, may become in time a dominant or standard application and vice verse. It is well worth spending some time considering what are the basic underlying data transfer operations associated with existing and perhaps future applications.

To be used in the development of scenarios, Data Applications are defined not only in general terms of what they provide for the user, but more importantly in strictly limited terms that enable simulations of use in engineering models. The quantitative description of each Data Application is often a theoretical model, rather than an empirically derived, statistical model. This is particularly so since we are dealing with future uses of applications that are largely unknown. What FLOWS elected to do was to select a small number of well-known applications that represent a sufficient range of demands on network services to be a useful model.

2.3 Application Packages

As well as the meanings of Application Domain and Data Application, there is another use of the word "application", that refers to how people use a combination of a number of Data Applications together with various network and content services. This combination or package is optimised, or at least suitable, to support activities within an Application Domain, ie reflect specific user requirements. These groups of Data Applications can be called Application Packages. In other words, Application Packages use a number of Data Applications to undertake particular tasks, or to support particular activities, relationships, etc., that are identified in the user scenarios and research on the environment of use. An Application Package has a description based on what someone uses a device and service product for and the symbolic meaning they give it. It has a much richer description than the functional description given to a Data Application.

The concept of the Application Package is important when the actual Data Applications that may be available in the future are in some degree uncertain. Application Packages are identified from a user perspective (Cook and Aftelak, 2001, Cook, 2002, Hickey and Pulli, 2001), They describe what a user wants from a technology, and the role it plays in their everyday life. The concept is critical in the development of intelligent systems on which the user can set preferences and establish a profile leading to greater personalisation. The

names given to them reflect what they do from the user's perspective, not from the perspective of the types of data exchanged: eg a City Survival Kit describes how many people use their mobile phone today, a use that can certainly be enhanced considerably with new technology.

Any device is likely to contain a number of different Data Applications that could be configured together in different ways to produce different packages, eg a single device could be used for tele-working, maintaining family intimacy, and media consumption. The existence of different packages or configurations on that device reflects distinct and separated roles in a person's life (Nippert-Eng, 1995, Gournay and Mercier, 1998). However there are an increasing number of packages that enable people to integrate different parts of their life, as well as keeping them apart.

Applications Packages can be strictly defined by application providers and controllers, or shaped by users responding to pricing, quality of service, etc with particular patterns of use. Technology producers attempt to link together a number Data Applications into a single package (a PC "Office" suite), but also recognise that standards-based interfaces (eg web browser, operating system desktop), enable users to configure their own package of Data Applications.

Application Packages are generally supported by a "matching" Service Product that provides all the Network Services and management that that package requires. However, a user may not find a suitable product from any one supplier, so will buy or obtain from several sources, for example WLAN roaming and GSM from different operators. The value added by the application and device producers is in creating a product that can manage, and switch between the Service Products of the different network suppliers (eg UMTS from one supplier and WLAN from another).

3. The Socio-Technical Approach

The basis of much of technology studies is the idea of the "socio-technical". Devices, Services and Applications are not just technical, but socio-technical constructs embodied in infrastructure investment, devices, service agreements, business models, and use conditions. The availability and development of technologies are not based solely on what is possible, but what people and organisations decide to make possible (Williams et al., 2005, Williams and Edge, 1996).

An example from mobile telephony is the GSM phone service. The user does not simply buy a device to use voice telephony, but needs access to a range of technologies, services, commercial contracts, social norms, legal rights and restrictions, etc. The service "package" is shown in Table 1.

Network Service Product:	**Extended Device and Application Package:**	**Use Factors**
Wireless speech service + connection service + location service	Phone Device	Social rules on appropriate use of mobile phones : locations of use, topics of conversation, sharing, messaging, etc
Network coverage (physical access to the radio network)	Charger + electricity	
Service agreement (contact between user and service provider)	Net services - e.g. call diversion, voicemail, mailbox, SMS forwarding,	Bill-payers rules on use: e.g. parents, corporate

Payment method/agreement – prepay, pay monthly etc.	WAP gateway (Network Data Applications)	
Time/price/minutes/subsidy and contract	Subsidy – related to integration with Service Product	Personal usage patterns and meanings: personal rules, reliance, habits etc.
Roaming agreements between networks (national and international)	Insurance for loss or damage	
Wireless device operation license (granted to operator)	Customer Services	
Customer Support services		

Table 1The Socio-technical Mobile Phone Package

The particular combination of factors shapes how the application is used by the user, eg constant calling, emergency calling, SMS dominating over voice calls, always having the phone on etc, and whether it is suited to the Application Domains they are used it within, and the Application Packages that they use. Another example of a social-technical definition of a service/application is Internet access. Although we have a common understanding of what this is, it is actually a range of possibilities: a set of possible network services based on a service agreement: pricing, allowed times of use, maximum bandwidth availability, quality of service or particular sub-services, allowed access locations and devices, various network services (mailboxes, caches, content filtering or digital rights or censored content, firewalls etc.). It is therefore important to define precisely a range of factors, even when using an apparently neutral term.

Any new application, service or device has to be analysed within a socio-technical framework. This means user scenarios are socio-technical, describing not only social and personal activities, but also interaction with the physical world and the world of machines.

A socio-technical approach also treats technical change as a socio-technical process – not defined purely from the independent emergence of new technologies and techniques. This research is based on a social shaping perspective, that suggests technology is developed and deployed as the result of the complex interactions and actions of social actors including firms, governments and various user groups through market and other relationships. Even end users, with little direct influence over product and service development, adopt and domesticate new technologies in ways that can eventually have profound impact on the future direction of technological change. One may suggest that real or imaginary knowledge about users and customers is becoming one of the most important actors in the social shaping process today (Williams et al., 2005). For this reason, understanding people's everyday lives, specific life events, and the way that people actively integrate technologies into the those lives in practical and symbolic ways is very valuable to those making decisions concerning investments in technology R&D, deployment and marketing. It is also important to be critical of the sources of information about end users, and recognise the need to keep new knowledge about users flowing into any technology or service development throughout a project.

3.1 Analysing Users' Activities and Applications

There are many ways to understanding users: studies of wireless technologies and of other information and communication technologies have yielded many different ways to view users,

and the way they use technologies. This includes why they use them, how they use them, the motivations and problems they have, and concepts such as role, behaviour and community, etc. Recent books and collections (such as Brown et al., 2001, Katz and Aakhus, 2002, Ling, 2004) on the use of mobiles serve as sources. One of the problems with looking at the future is that it has not happened yet, and mobile phones have only been available for such as short time. However, there is plenty of research on how people live their lives and work together, which change much more slowly than the technology, so provide good grounds for speculation.

There are many ways to approach understanding how and why people use technology. Traditionally the concept of application domain or use has been based on some function that an industry sector provides eg education, work, entertainment, shopping (selling), leisure, communication etc. Alternatively, in studies of how people use ICTs it is common to base the analysis of types of information activity: information seeking, browsing, access, communication, transactions, media consumption, play. However, studies of users will often focus on other type of uses, understanding the concept of application in very different ways:

- Knowledge, Communication, Service, Play, Verification

- Immediacy, Intimacy, Flexibility, Freedom (closeness of human relations)

- Belonging, Playing, Coping, Survival, Balancing, Delivery, Control, Freedom (related to balancing activities and relationships)

- Time saving, Time wasting, Time filling (related to time use).

The development of quality research and useful scenarios relies on bringing together a range of disparate perspectives: in this case the analysis of the application and use of technologies is greatly strengthened by using multiple frameworks.

4. The Context Perspective Framework

There are many ways of looking at the users and usages of technologies, and of mobile or wireless technologies in particular. Categories can be based on what individuals or communities of users use technologies for, on particular Application Packages, or on the places that wireless technologies are used. Users can be individuals, but also organisations that provide individuals with wireless technology, and the suppliers of technology infrastructure. However, the role of this chapter is to go beyond a person-centred approach, and try and describe the context of use of telecommunications services. This entails describing the locations of use, and the devices and application software used to access them. This approach draws on the sociological, ethnographical, cultural and geographical study of ICTs in general and mobiles in particular (Katz and Aakhus, 2002, Ling, 2004, Ling and Yttri, 2002, Lie and Sorensen, 1997, Ling, 1999, Haddon et al., 2001, Haddon, 2001, Haddon, 2000, Gournay and Mercier, 1998, Grant and Kiesler, 2001), business/design literature on mobile futures (UMTS-Forum, 2002, UMTS-Forum, 2000b, UMTS-Forum, 2000a, Cook, 2002, Cook and Aftelak, 2001, Dietrich and Eichner, 2001, Woodward et al., 2001, Lehr and McKnight, 2002), and technical descriptions, for example in 3GPP (3rd Generation Project Partnership) specifications (3GPP, 2003), or in work done in the FLOWS project redefining network services and application descriptions.

A Context Perspective Framework is a way to structure the bringing together of material for the creation of user scenarios. This approach reflects a number of different analytic perspectives on ICT use, and the needs of this project. Within this framework four perspectives are used: Location, People, Device and Application Package. For each perspective a number of characteristics are developed, relevant to the characterisation of services, ie in relation to geographic space, number of users, Data Applications, demand for services, quality of service expected etc. Much of the quantitative data for this available, although there still large gaps in knowledge about what traffic patterns will actually be generated by users. There is also qualitative data, but here to there are limits on how this can be translated into scales that can be used in scenarios useful to engineers. Within each perspective a number of examples or context scenarios identifying relevant characteristics are

developed. This provides a framework not only to understand service requirements, but also to develop further in-depth user analysis.

The context perspectives are not mutually exclusive: users move through particular locations, using particular Application Packages, these Application Packages are used by a range of different users, and locations are inhabited by a range of different users. This overlap strengthens the different scenarios by cross-referencing, and also helps generate a large range of possible user scenarios more easily.

In order to identify the characteristics of the various network services, a Data Application (eg video streaming) is chosen and the information about where, how and who by can be found easily from the scenario outline tables showing the range and constraints of possible uses of the application and the services needed to support it.

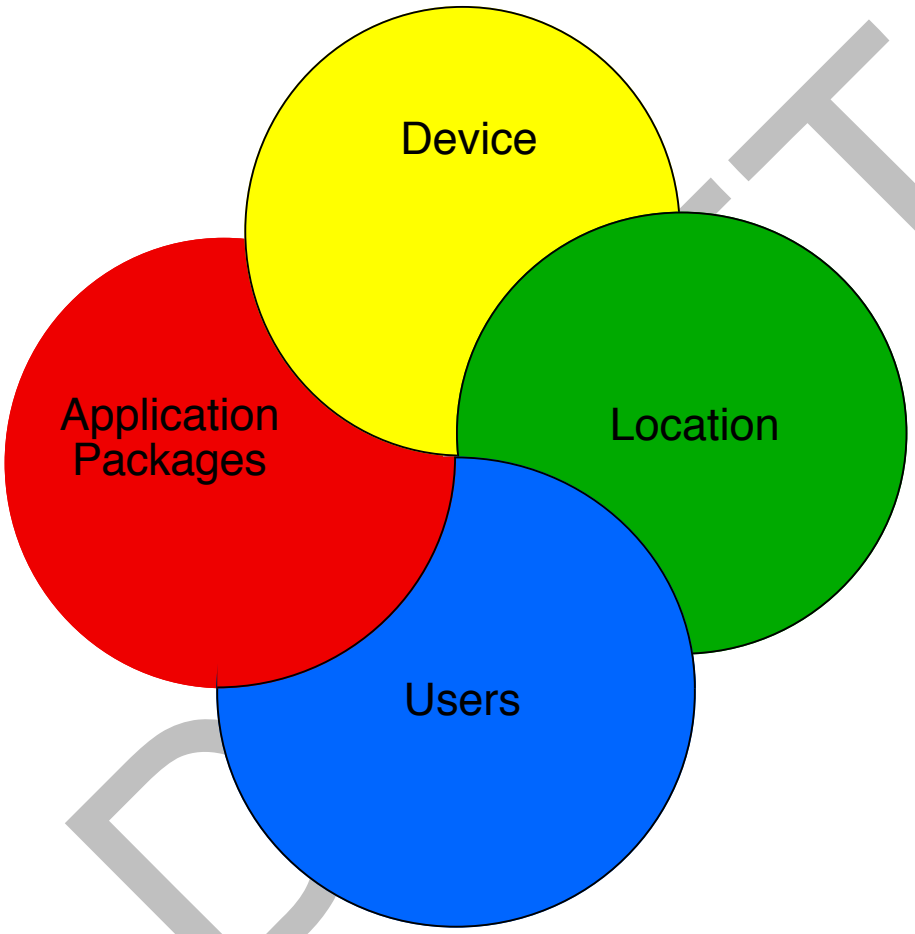

Figure 2 Context Perspective Framework

4.1 Location Perspective

A key dimension to the use of mobile and wireless services is the location where they are used. Mobile technology opens up many new spaces to the use of ICTs, and this perspective highlights particular spaces that people move through and to in the course of activities, especially those that are by definition related to travel and temporary occupation. The key characteristics of locations are: physical characteristics of the place, number and type of users occupying or passing through the space, time and space distribution of users etc., the applications and services that they use, mobility within the location and limitations, and the infrastructure deployment including cell size. For the social and commercial analysis there are characteristics of control of the space, competition and provision of wireless services, inter-regional and international roaming. Physical descriptions of locations can be obtained from measurements made in studies of radio propagation. Human use of locations is obtained from

studies by urban planners and architects, specific studies, and details of current wireless use from mobile operating companies.

Examples of locations include airport, railway station, tourist city centre, industrial estates, suburban home, open plan office, school, shopping mall, high street, sports centre or stadium, exhibition centre. It can be extended to rather more restricted spaces such as a car or train too.

Locations can be quantified in terms of topography, geography, and type of wireless cell availability, density and number of users, and typical use of wireless infrastructure (Stewart, 2002).

4.1.1 Example Location: Shopping Mall

The shopping mall can be characterised as a space located in city centres and suburbs which attracts large numbers of visitors, with varying levels of occupation, depending on time of day, day within the week, and time of year (eg seasonal shopping such as Christmas). Shopping malls are perceived as centres of leisure and entertainment and a range of facilities, such as restaurants, cinemas, hairdressers are available in addition to the range of stores. Shopping malls have also become popular teenage hangouts. However, some people find them very stressful, and try to spend the minimum time needed shopping. Highly connected mobile devices for consumers are a shopkeeper's nightmare. They enable customers to compare prices, availability and design right in their store. However, wireless technologies could offer the opportunity for shopping centre and shop managers to add an extra dimension to the shopping and selling experience.

Physical Characteristics	**Type of users**	**Data Applications**	**Mobility**	**Device**	**Infrastructure**
Indoor open space: with narrow corridors and enclosed shop spaces. Glass, concrete, steel construction Most areas publicly accessible, except for staff only areas (e.g. security control room, staff room, stock rooms, etc…) Outdoor / Indoor space: adjacent areas (e.g. parking, small parks)	Families Teenagers Tourists Other shoppers (young professionals, students) Staff (commercial premises, maintenance, security) Business people Construction personnel	Products information search (inc. price, location product within mall and ordering facilities). Secure Payments systems Bank account access Email Multimedia Messaging News Voice Web browsing Music Games	Walking Browsing Sitting Vehicular (car park)	Basic devices (phone, PDA) PDA+ for stock-takers, delivery Pen size (Ultra portable) Laptop	High provision of infrastructure Public pico and microcell GSM and UMTS, Public WLAN and private WLAN for shops. Competing and locally provided cellular access Short Range radio systems

Table 2 Shopping Mall (Stewart, 2002)

4.2 Users/People Perspective

The viewpoint of users, or more correctly people, focuses on the activities, community and resources of individuals or specific groups such as a family, across their entire life-space. It links the high level ideas of life themes and life projects to the everyday management of the life space, performance of activities, consumption and integration into community and organisations. Of course every individual has their own pattern of usage, but it is possible to suggest a number of example types of user around which build a scenario of needs, behaviour, resources, etc. Possible user types include: teenage school child, student on campus, high level travelling business executive, stressed commuter in large city, service engineer, or regional sales manager. Users are chosen from a range of people identified in the literature as having particular uses of information and communications, and as being especially "mobile". The scenarios can be based on some sort of functional description of the person, eg their job or life stage, or on some other characteristic. They are not intended to be based on existing proposed classification of technology users, but could be based on various other lifestyle or marketing categories. The greater the number and greater the variety of examples to draw on in later developing user scenarios the better.

In this case a heterogeneous range of people with different resources, activities and needs was chosen. In doing this, an attempt was made to balance selection criteria based on traditional demographic factors, lifestyle factors and groups identified in the literature on ICTs and mobile telephony. The relevant characteristics of the user that suggested are location, mobility, Application Package, affordability/resources (including cost of services, devices and support), flexibility (level of service expectation, eg the need for constant availability), including the user profile and devices used. The social and economic themes and characteristics include issues of freedom, independence, control, surveillance, coping, identity, and community. The way to measure and quantify some of the characteristics certainly needs future work, but they provide a starting point.

4.2.1 Example User: Commuter

This is a common example in the mobile literature. The suburban commuter uses wireless devices extensively while travelling to and from work during the week, as well as during excursions at the weekend. The offerings of the technology are an essential and integral part of these daily trips, to keep in touch with work and personal network. It also provides distractions from the boredom, stress and routine of travelling, while making use of this time. Themes include coping with the stress of life, balancing home and work, maintaining personal control and managing family life (Gournay and Mercier, 1998, Haddon et al., 2001, Kopomaa, 1999, Crisp et al., 2002).

Location	**Mobility Importance (1-5)**	**Data Application**	**Total Affordability**	**Flexibility in access and reliability**	**Dependency**	**Device**	**Application Packages**
Train, bus (i.e. public transport) Car Office Supermarket Shopping mall Pub Home	Fixed (3) Pedestrian (4) Vehicular (4) Highly vehicular (4)	email, file transfer Voice call Time-killing Games Bulletin Boards Web Browsing: Product information	Medium	Medium	Emotional: high Practical: medium - high	PDA Mobile Fixed PC at work and PC at home (possibly other terminal type)	Personal Networker (heavy) City Survival Kit (heavy) Media Consumption Portal (Heavy-moderate) NSW: mobile office, Intranet

Lives within the greater city area and moves around public transport routes to centre and between suburban locations.		News Travel information access Video clips Music					(moderate)

Table 3 Commuter

4.3 Application Package Perspective

The Application Package relates to the particular activities that a user is engaged in, and the set of Data Applications and services that are relevant to that activity. The concept of Application Package links the activities of users to the use of the technology. Application Packages refer to particular activities, such as education, work, leisure, life management, but in rather more focused way than Application Domain. The Application Package scenarios identified include several types of Network Supported Work: the Mobile Office, Corporate Intranet Connection and Remote Monitoring/Control system, the "Traveller's Aid", the "City Survival Kit", the "Media Consumption Portal", and the "Personal Networker".

Characteristics of applications identified are: information and communication tasks, Data Applications and usage (time and location). The personal social and economic characteristics include: immediacy, cost, competition in provision, control over provision and use, transferability between devices, and reliability.

Here four different application packages are illustrated; three that can be classed as network supported work tools, and one entitled the "City Survival Kit":

4.3.1 Application Packages: Network Supported Work Tools (NSWT)

Tele-working has traditionally been seen as working from home, but is increasingly recognised as any sort of peripatetic work – people working out of a car, or truck, plane or tractor, or indeed anywhere (airport, building site, oil rig, other people's homes etc). Application Packages for tele-work have been termed Network Supported Work Tools (after the term Computer Supported Cooperative Work, CSCW), and include applications for a range of different types of work. Work on CSCW in mobile environments has been developing ideas in this area of several years (eg Dix and Beale, 1996b, Dix and Beale, 1996a). These tools give flexibility, and enable workers to be in contact on-site, or available wherever they are, connected to their organisation's management and communications systems. This enables them to receive instructions, submit information on work progress, query colleagues and databases, or monitor remote systems. This can mean considerable efficiency and effectiveness gains, and reduction in costs. It may mean working at home but being in contact with colleagues at work and with customers through video/voice/data sessions (virtual office). It also means collaboration between geographically separated persons, possibly a group of them. Here too, the ability of telecommunications to deliver video and sound as well as real-time data may allow users to avoid costly and time-consuming travel. Application developers have caught on to this opportunity. A variety of screen sharing tools provide users with the means to work together in real-time on the same electronic documents while being in visual and audio contact. These tools not only enable people to work, but also undertake training, and juggle their work and home lives. (Gournay and Mercier, 1998).

Here are three brief examples different network supported work tools:

Intranet Connection: for the Mobile enterprise, the wireless link is seen as an extension of the corporate intranet, with corresponding expectations on availability and bandwidth. The

application enables access to a network, to take out and feed in communications and information. People with this package can maintain a presence in a virtual office, and enables organisations to deploy “Mobile Enterprise Systems”. It offers a rich variety of office type Data Applications from voice telephony to document sharing.

Mobile Office: rather than being a remote mobile part of an intranet, the mobile office acts as an information and communications hub for its user, enabling them, for example, to run a business from wherever they are (Laurier, 2001). The independent worker uses network-based applications (voice, mail and web and other application servers) as well as portable devices.

Remote monitoring/control System: here the mobile device is often connected another mobile device (eg diagnostic tool or surveillance device or other remote machine such as a health monitor, car engine monitor), to enable this system to communicate to a remote human or machine (eg remote surgery, engine diagnostics, video surveillance). The remote device can be controlled by a co-located person, remote person or be independent. Part of a machine to machine network. Ubiquity of coverage may be more important than bandwidth availability. A system often used by a “Clipboard Technician”.

4.4 Example Application Package: City Survival Kit

A common use of mobile technology is to cope with the stresses of living and working in a busy city where every activity involves travelling and dealing with the uncertainties of modern life. This package is chosen by the user who is often on the move, trying to make rendezvous’, dealing with public transport delays, the demands of work, family and friends, paying bills and ordering shopping while travelling, finding out what’s on, what is available, and where things are. Location-based applications could be important (Townsend, 2002, Sherry and Salvador, 2002, Kopomaa, 1999). Clearly this is the sort of package that could be popular with commuters and city dwellers.

Uses	**Data Application**	**Key Values**	**Usage**	**Device**
Keeping up with social network, and work: Messaging, Bulletin Boards, Phone Transport info: Train times, traffic alerts Terrorist/ accident alerts Shopping Paying bills Local timely information: What’s On Games – time filling and wasting Music (listening and purchasing)– time filling News Television, movies and radio (live, on-demand or pre-recorded)	Web browsing Email messaging Voice call Instant Multimedia messaging Games Video on demand	Coping Freedom Control Awareness Time saving	On public transport or in the car, but also in places en-route. Used in work and personal time.	Basic devices (phone, PDA, laptop) Extended basic mobile phone. Maximobile (pocket size but heavier features) Pen size (Ultraportable) Emphasis on portability and design with some extra functionality.

Table 4 City Survival Kit

4.5 Device Perspective

There are a number of core mobile devices; the phone, the car and the PC being the dominant today. But there is a great deal of innovation going into developing devices with a range of forms, encapsulating different technologies, and for different uses. There are a number of possible devices that services can connect to, applications run on, and which offer different levels of portability. The characteristics such as form factor, (size, shape), power source and Application Packages of a device shape the possible uses, users, usages and connectivity. Of key importance are not only the stand-alone capabilities of the device, but the degree to which it can interconnect with other wireless and wired devices. Many Application Packages will run across a range of devices, and most users will have access to several devices simultaneously or in different parts of the life space, eg the phone, laptop or PDA can always be updated from a computer and fixed wire link at home or work on a regular basis – ideal for many asynchronous solutions. Users may increasingly expect to be able to switch a call or data session from one device to another, or conduct different parts of it over several, not only in the familiar user-configured way (eg using phone and playing an online game with a friends), but through an integrated communications system. In its most integrated form this has been termed the virtual terminal (Thank et al., 2001). A number of types of devices (or device scenarios) have been identified in Table 4.

Characteristics of devices include: portability/wearability (Fortunati, 2002), human interface, modes of communication (text, voice, image etc), cost of ownership and use, power requirements, processing power, range of Data Applications, locations it can be used, social acceptability etc. Location and device will have a shaping effect on what can be used, or is inappropriate to use (eg sending text message/e-mail in library, but not talking on phone). Locations imply some restrictions on type of use as well as use of particular devices in general, eg a laptop can be used on a train, but not the metro at peak hours.

Basic formats	
Size/name	*Description*
Mobile phone	Portability, low-end memory and processing power applications and Application Packages
PDA size	Portability, multimedia data communication. Many possible applications and packages
Laptop	Full computing and interface power, many applications
Extended Basic Schema	
Mini-mobile/ mp3 player	Emphasis on portability (<100g) for basic communications and info, or music playing. Limited by screen size and battery size.
Maxi-mobile/ Smart Phone	Jacket pocket or handbag size, but heavier on features (big screen, PDA, camera etc)
PDA/GameBoy size	Palm size considerable computing power, carried in bag, some pockets. Clip on keyboards etc.
Web-tablet or PDA+	A5-A4 size. Tablet, PDA with extra devices attached (e.g. GPS, printer), too big to go in a pocket, but can be carried by hand or in a bag.
Mini-laptop	Scaled down laptop, with keyboard - goes in small bag, many features of PC laptop: bag size, full power, keyboard.
Lap-top computer	Full featured computer with large screen, multiple ports, disks etc. Luggable.
Other Formats	
Vehicle Based	Provides more powerful communications and IT facilities in a mobile location. Provides a hub for portable devices.
Communication hub:	Communications device that is carried separately to other devices, possible to get better signal or to avoid radiation. This could be small or built into briefcase, etc.
Clothing Based	Integration into clothing links telecommunications intimately with the wearing of that clothing (esp. work clothing)
Badge	Wearable delivering context awareness and presence
Pen or Watch size	Ultra portable

Table 5 Device Scenarios

4.5.1 Web Tablet/PDA+

The PDA+ or Web Tablet format is larger than a standard PDA and also much heavier on features. In 2004, web-tablets with a large screens were rare, but the PDA+ is a widespread format in commercial use (warehouses, logistics, retailing, utility companies, highway maintenance etc). These products tend to be used by corporate/commercial users, “clipboard technicians”, who find the portability of heavier-featured devices particularly appropriate. Cheaper and more fashion oriented designs of the device may appeal particularly to the youth market and chatterers, with features and uses centred on MP3, media consumption (games, video clips) and personal network applications, where the device offers a larger screen and longer battery life than smaller devices. Often based on a PDA size pocket computer device it can be enhanced with features such as a large screen, printer, a camera, larger battery, a small text or music keyboard, hard disk drive, or specialist modules.

Characteristics	**Mobility**	**Size / Weight**	**User**	**Location**	**Application Package or Specific Data Applications**	**Performance**	**Support Network**	**Extended features**

Portable Built-in antenna or fold out slate Context aware Touch screen, speech, handwriting input Detachable keyboard Screen size (up to approx 11 inch)	Fixed (5) Pedestrian (5) Vehicular (5) Highly vehicular (4)	200x100x50 900g-1500g	Mobile workers (Service Engineer, peripatetic Manager, etc…) Business Travellers Teenagers Chatterers Tourist	Indoor /outdoor Urban /rural E.g. Industrial Estate, Airport, Tourist City Centre, Suburban Estate, Financial District, Shopping Mall, Public/Private transport	Network Supported Worktools Personal Networker City Survival Kit Traveller's Aid Media consumption portal	High level and processing power for business / heavier featured devices Standby time up 72 hours	WLAN GSM/GPRS Bluetooth (PAN) UMTS DxB	Bluetooth headset Notebook Desktop Computer Car (docking station) Other peripherals (printers, etc, can be built in to this format.

Table 6 Web Tablet /PDA+

5. Scenarios

The aim of scenario development is to create models for testing, design, simulation and market studies, and a common framework for all the team members to work within. Scenarios must be built with a clear set of inputs and variables that can be changed in a way at different versions of a scenario can tested or investigated. Assumptions, uncertainties and gaps in knowledge should be stated, and sources of inputs provided.

The scenarios developed here enable the linking of research on people to visions of possible future wireless devices, to quantitative descriptions of a number of Data Applications and Network Services. This is done through User Scenarios developed from a combination of the context scenarios presented earlier. Context scenarios of individuals, applications, location and device are linked together and developed in a rich and more specific narrative and description. This could of course be largely fictional, or based on particular set of research findings. For example, a scenario developed around a building site would link information about all those who come into the site, and communication needs of key users as they move between the site and other locations.

However, user scenarios alone are not sufficient for use in system or service development. There must also be input on definition of network services that can be provided, and on the infrastructure that will provide this. One way to do this is to use Service Scenarios and Access Technology Scenarios that can be brought together with user scenarios developed using the context perspective approach (Aguiar et al., 2002) (Figure 3).

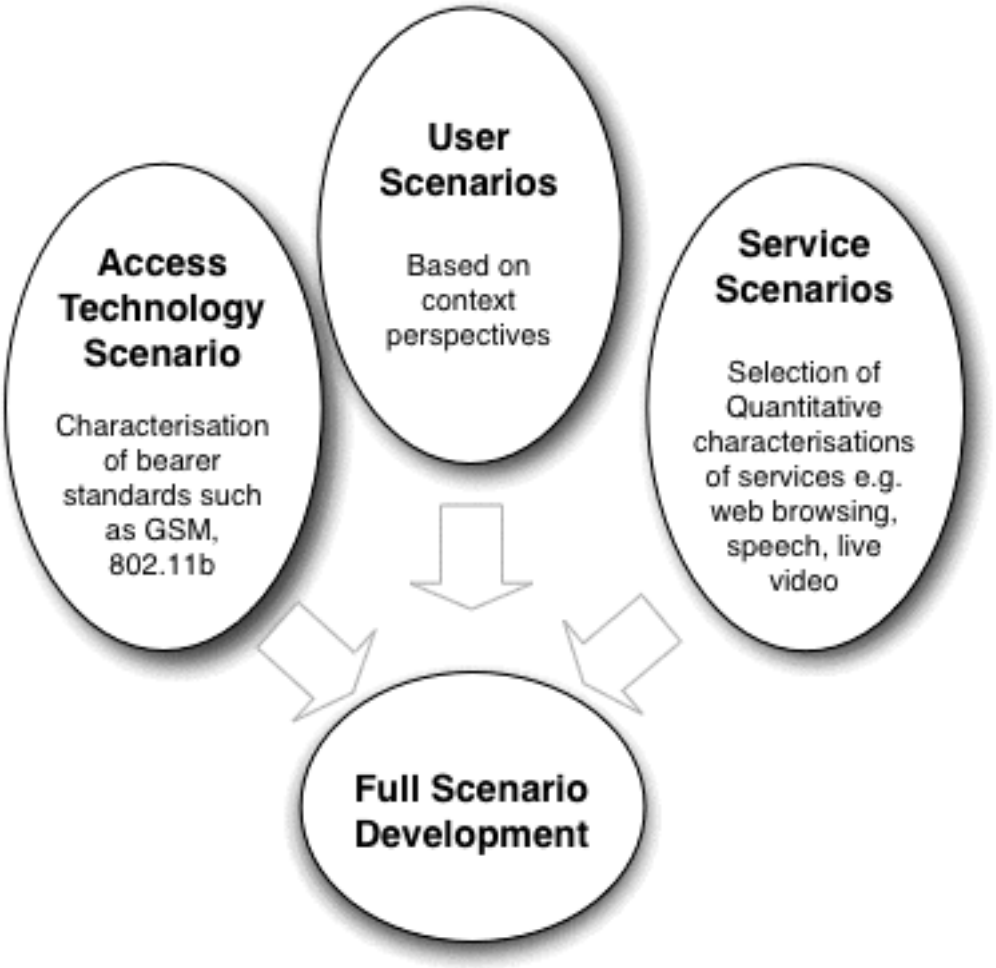

Fig. 3 Combination of different types of scenario inputs

Figure 3 Combination of scenario inputs

5.1 Network Service Scenarios and Access Technology Scenarios

The Network Service scenario describes the demands on the device technology and networks by users making use of particular Data Application while going about their everyday activities. These descriptions include both empirical measurements and derived models. They are principally technical scenarios that define and describe a set of a network services. Service Scenarios involve the choice and characterisation of a range of Data Applications and Network Services, providing a detailed description of the parameters that define them. The Service Scenario describes the service capabilities that the network and the devices will be required to deliver. These parameters are grouped into three categories: bearer characteristics, traffic characteristics and performance requirements and include a number of services, quality of service, bandwidth/data rates, connection orientation, symmetry, security, switching between bearer services etc). It will indicate what combination of access technologies could provide these services, what functionality is needed to support simultaneous use of these technologies and the limits on use that these access technologies impose for defined levels of infrastructure availability. The scenario will include services such as voice telephony, file transfer, services for real-time gaming etc.

Access Technology scenarios describe the bearer standards that could be used to provide network services to users. In the current wireless world these include various WLAN systems, Bluetooth, GSM and UMTS, but a future scenario may also include various 4th generation or alternative systems. A scenario describes the combination of standards, available, which

helps determine what network services might be able to be provided, the number of users that might be supported, and the types of mobility possible.

5.2 Creating Scenarios

Full scenarios are created by bring together User Scenarios, the Service Scenario and the Access Technology Scenario. However, a single unified scenario is not sufficient for the needs of a diverse development team: engineers working on networks and those working on radio access have very different needs. Therefore a number of different, related, scenarios have to be built, which is why the development of a framework it so important. In this project two different sorts of scenario were developed; those related to the network demands of particular users— User-centred scenarios — and those related to the aggregate demands of users in a particular location, and the propagation characteristics of that location — Service Provision Scenarios.

For example, a User Scenario with a builder calling from a site discussing and modifying plans with the architect using a virtual workspace package with access to WLAN and UMTS networks is linked to the Service Scenario that includes a characterisation of a voice and data, video call with particular network infrastructure and technologies described in the Access Technology Scenario. A Service Provision Scenario describes the use of wireless services by all those in the building site, the physical characteristics of the space, the access infrastructure and the social relations and control.

5.3 User-Centred Scenarios

These are scenarios based on individuals moving though different places over time, using a range of devices and applications. They are used by engineers and planners working on devices and higher levels of communication, for example, hand over between different bearer systems, device power requirements, or requirements of specific end user markets.

Just as the User Scenarios describe more than one particular activity, a complete user-centred scenario is a description of all the different network services across a range of locations that a person or group makes use in the user scenario. This could include their home, their car driving around a town or motorways, their office or school, visits to friends, shops etc. It describes what they do in each place, who they communicate with, the technical facilities available, the environment, the social organisation of each place, and the position of the person within that organisation, and many more factors as are deemed relevant for the particular use of the scenario. These user centred scenarios are the basis of Service Product Scenarios, developed later.

5.4 Service Provision Scenarios

Service Provision Scenarios are needed for developers and researchers focusing on locations, developing channel models, or calculating the provision of radio access points that will be needed in a particular place. They require Service Provision Scenarios focused on place, rather than individual users or applications, aggregating all the users in that location. This includes information from the user scenario, such as number of users (given by per cell or per km2), spatial distribution of the users, position and mobility of users, services used by users, and traffic models for those users, and details from the location such as available access technologies, geographical and topographical descriptions to create a propagation scenario. This type of scenario is a richer version of a Deployment scenario (Velez and Correia, 2000). Those studying social aspects of sites will want information on control of the space, social rules, activities and relationship in those sites.

For example, these service provision scenarios could be build on user scenarios such as:

- 50 people in an small airport lounge uploading files from their laptop computers and PDAs within 5 min period via WLAN network, but with UMTS via pico-cells also available; making voice calls from phones, and browsing for travel information on PDAs.

- 100 people making phone calls, 20 people playing on-line games, 150 sending and receiving small multimedia messages within a school playground with UMTS micro-cell and WLAN picocell.

For the FLOWS research on propagation, five locations were identified for testing (office, town square, enclosed corridor, suburban and rural), and the service provision scenarios were based around actual measurements taken in examples of these locations.

5.4.1 Scenario Instances or Use Cases

In general these scenarios are still too broad for most testing and development, so a series of quantified use cases or scenario instances have to be developed. These describe specific activities, and it is here that the scenarios have to be most explicit. Use Cases have to be developed for the specific needs of the scenario user, and in consultation with them. Changes they make need to be fed back into the main scenario. In the case of our project, FLOWS, these instances needed to highlight the demands of simultaneous use of multiple bearer services.

Example Scenario Instances include:

- Making a multimedia call on a PC while travelling in a train at 120 km/h in an area of macro-cell coverage using UMTS

- Switching from a narrowband service to a broadband service during an interactive web browsing session on a web-tablet while stationary in an area with pico-cell coverage (eg GSM to WLAN or UMTS).

- A streaming video service switching between broadband bearer services with a change of mobility from stationary to 30 km/h travel in an urban area (eg WLAN to UMTS).

- Switching an interactive document editing session from a stationary laptop PC with WLAN connection to an outdoor pedestrian using a PDA with UMTS service.

- Playing a real-time videogame on a GameBoy with average bitrate of 50 kb/s in a bus averaging 30 km/h over UMTS.

- Making a GSM call on maxi-phone while downloading a series of 30 kB images via GRPS.

- Switching broadband service due to congestion on one in an airport (eg WLAN to UMTS).

- An interactive e-mail session via GRPS on a train that delays downloading large documents until WLAN contact in a station.

5.5 Understanding Scenario Connections

Figure 4 shows how a set of scenarios are constructed from Context Scenarios and the Service and Access Technology Scenarios. First, a User Scenario is created by combining a number of different context scenarios describing the four key dimensions of end user use of wireless technology: location, Application Package, user/person and device. In this case the user scenarios are centred around a particular user, who moves though several places, using different devices and Application Packages. This User Scenario in used in conjunction with the Service Scenario to describe a User-centred Scenario: all the services and conditions that the user is described as using. Particular instances of use of convergence technology are

highlighted as Convergence Scenarios. Another Scenario, this time describing the Service Provision requirements for a particular location is also generated, based on the User scenario, but this time centred on a particular location within that scenario. It aggregates the users, devices and applications used within that location.

There are yet more scenarios that this technique could be applied to: device-centred and application-package-centred scenarios would be useful in defining and testing the range of conditions under which a particular device or Application Package could be used.

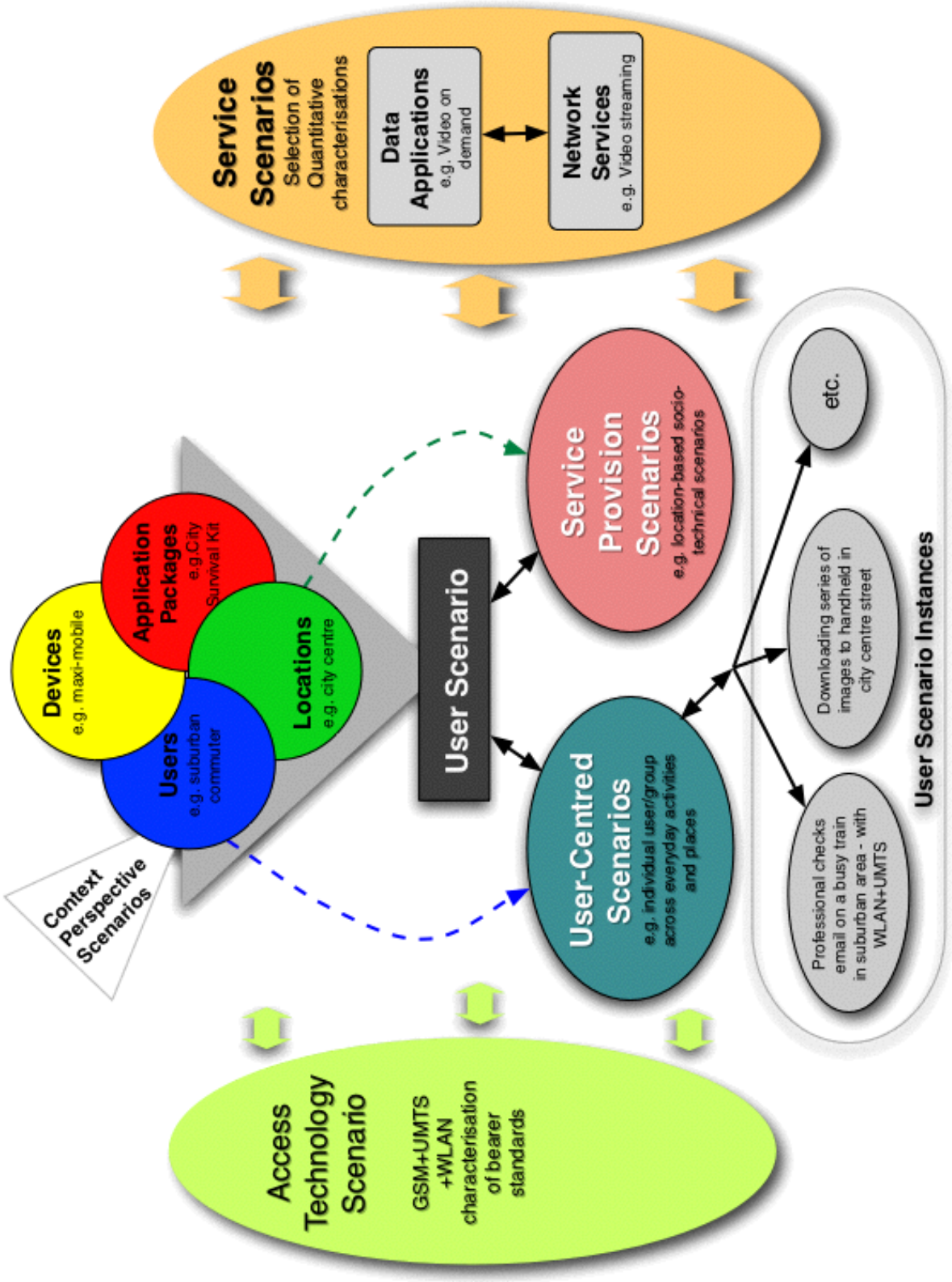

Figure 4 Scenario development

6. Example Scenario Development

A “story” scenario is common within the industry and design methods. Sometimes they are based on purely tacit knowledge of engineers set up to test particular technological

configuration, or as a way of illustrating the results of foresight scenario building exercises or built from specific user research. These narratives bring the research data to life in an engaging manner, but at the same time they can be dangerously alluring and justify the logic of a technology. They can also be taken out of context, as somehow being an important part of a scenario, rather than part of a process, and a bridge to the original research. Three stories were created to illustrate different types of uses of the technology under assessment, and a range of people and places. In many ways they are quite conventional scenarios – the male business traveller, a family on a weekend trip to the city, and a self employed peripatetic service engineer. The careful reader will notice that broad environmental trends are hinted at, but these examples made no attempt to engage with these seriously as has been done in many other top-down scenarios developments.

For each scenario, the scene is first set by bring together the information already gathered in the context perspectives, adding some more specific ideas. Scenario Instances are developed from this. The examples given were developed for this particular project's needs – to test the idea of simultaneous use of standards – concurrent use or sequential switching between different radio systems. Here one of the scenarios is given.

6.1 Business Traveller on the Train

This scenario describes a business traveller on a medium distance train travelling from the city, through the suburbs and rural areas, stopping regularly at stations. The main user is conducting business activities with a Network Supported Work Tool and some personal communications. This is a very typical example, but developed according to the framework.

6.1.1 Scenario and Activity Description

Brief Access Technology Scenario: UMTS in city and urban parts of journey, WLAN connectivity in stations, GSM connectivity everywhere. Digital Terrestrial broadcast, Bluetooth in each carriage.

Principal User. (This is elaborated from person described in a context perspective earlier). The user/customer is a business executive who is travelling to a meeting. He is male in his 40s. He needs to communicate with his office, with other colleagues in his organisation and with clients. He has access to on-line resources on his corporate intranet which he uses in his business. He also submits report and documents. He discusses documents with his colleagues on the phone and works on them at the same time. He is available to his colleagues and clients/ business contacts all the time, but is able to divert calls and messages to a secretary. He has great deal of resources to spend on communication and information exchange.

Home-work management. He has a family, but he travels away from a great deal, and keeps in touch electronically with phone calls every day, images and video messages, and occasional video call. He is also able to check on his young son at the nursery via their webcam. A suggestion that he would also have lover was vetoed by the project group, despite the interesting perspective on communication management that this involves.

He has some friends with whom he shares an enthusiasm for old cars, and other friends he sees on trips frequent trips to the city.

He lives in a suburb, and uses his car, the train and planes for travel. Most regional trips are done by train due to bad congestion on the roads.

Location: Medium Distance Train. The user is on a train that travels from the city centre across country for a trip of several hours. The train travels at speeds of 70kph in urban areas and 130kph in rural areas. It stops every 15 minutes for 3 minutes at stations. The business class coach on the train has power supply for travellers. The stations have WLAN connectivity and the train travels through areas of UMTS connectivity and continuous GSM connection. However it does go through tunnels that take up to 15 seconds to pass through. Within the

train there may be 100 people doing similar activities to our user. The train also has 200 students going home for the holidays, who are making extensive use of instant messaging, voice calling, on-line gaming and web browsing.

The Application Packages: Network Supported Work Tools AP1 Travellers Aid, Social Networker. He uses a set of applications that are provided by this employer to link him into the corporate network, and to enable communications with clients and business partner. The firm use a customised product provided by a major vendor that integrates multimedia data over a variety of networks. The package enables all the standard business documents to be worked on and shared, access to the corporate Internet and the Internet for communication, information, and making travel arrangements, placing secure orders and signing electronic contracts. The system will filter messages and webpages for unnecessary images.

He uses an Internet travel company website on the PDA to book hotels and a taxi.

He communicates with his friends and family on a separate integrated mail/messaging account through a web interface and the telephone

The Devices. He has several devices – a small mobile phone, a small PDA and a laptop computer. All the devices are provided by his company and access services provided through a single service provider buying in connectivity from infrastructure companies. He has a large brief case and a jacket pocket to carry them. Devices cannot be used in a moving car while driving, except to take telephone calls, or listen to e-mails and documents being read. The PDA and phone are seen as more convenient to use than the laptop at particular times, especially on crowded trains at rush hour.

6.2 Scenario Instances or Use Cases

He will conduct 1-2-1 and multi-way phone calls, upload and download documents up to 10Mb, and on this occasion, a 500Mb video file for a presentation. For one hour he will discuss a multimedia document with a colleague on the phone while editing the text it in real time together. During this time he will check his e-mail three times in response to alerts, downloading five large files to his laptop. He usually checks his e-mail on the PDA, but can synchronise with the laptop and download larger items too. Only one of the downloads is important and must be done immediately, the rest can be done whenever the network connection is fastest and cheapest.

He watches the business news on a subscription TV on demand service.

He looks at his child in the nursery through a low quality video link to his laptop web browser.

He talks to his mistress on his video phone.

He receives some small images from his children on his private messaging service, although routed through the company network.

He books a taxi, and checks a map of the place he is visiting.

6.2.1 Specific Data Applications:

File transfer, E-mail/ multimedia messaging, Voice phone call, Synchronous document sharing, Video on Demand, Broadcast Radio, Cooperative Document editing, web-browsing including video stream.

For the testing and design, specific convergence scenarios were developed quantify the conditions when “simultaneous” use would be put into operation. Most of these relate to demands of individual users are they switch data applications or move into different environments, but some relate to other types of events, such as the following example:

Example: While train is in a small town station engineers take down UMTS coverage of the area for 5 minutes, and system transfers all calls/connection to WLAN, GSM and GPRS.

Specific activity	Data applications	Network services	Geographical characteristics	Cell types	Network Availability	Mobility	Device	QoS expectancy
250 users File sharing Phone calls Web browsing	File transfer Voice calls Web browsing	Unrestrained Data transfer Speech Interactive services	Outdoor-urban Indoor-urban Outdoor-suburban	Micro Pico Micro	UMTS WLAN 802.11a GSM/GPRS	Vehicular Stationary Walking Vehicular-Highly vehicular	Phone, Laptop, PDA	Medium - High

Table 7 Scenario Instance: Switching all calls in small town between networks when upgrading network

7. Building on User Scenarios: Service Product Scenarios

The traditional telecommunications industry has sold bundled applications and services that they guarantee to provide at a particular quality of service level. By contrast, the existing Internet is predicated on flat rate access, with no guarantees on the performance of any applications ("best effort"), which are the responsibility of end users in an end-to-end market. In the future these two models are likely to come together. Mobile Network Operators (MNO) or Mobile Virtual Network Operators (MVNO) will offer network service bundles or service products that end users or resellers will be able to use to run a range of end-to-end data applications at a defined quality of service level. The framework can be used to suggest possible service products, based on the people, applications and places that they will be required. This is used in development and testing of the technology, market studies and assessments of costs and the likelihood of the role-out of infrastructure and commercial services that will be used to offer that particular product. A service product has a socio-technical definition, linking characteristics of particular services, delivered by different bearer services, and the requirements to provide a specific marketable service product. These products are defined by the particular network services they offer, the locations they are offered in, the price at which they are offered, the quality of service promised and expected, extensions to service available, variations within product (eg on pricing, add-ons etc) and the market at which they are aimed. Six example service products are suggested based on context scenarios. These are not original ideas, but are examples derived using the framework.

7.1 Mobile Internet/Business Intranet

This service can be sold to corporations as part of a "Mobile Enterprise" product, to provide their mobile staff with integration to their company's voice, video and data networks in location such as airports, offices, on the motorway, in trains etc. Service is provided at a flat rate

regardless of international or network roaming and is sold to commercial customers, often as part of a broader service agreement, such as Virtual Private Network (VPN) provision including voice. Users have Network Supported Work tools, and use multiple devices – phone, PDA and laptop, which may often be provided or configured by the service company. This is a product within the context of the mobile internet business model.

7.2 Consumer Multimedia Calling

A service product for people who like to keep in touch, send messages, make low quality video calls or multimedia calls, send personal photos. Access to information is not important. These users have a version of the Personal Networker Package. This is essentially a simple rich voice product based on extending the functionality of the mobile phone application package, and making revenues from occasional use of value-added services

7.3 Multimedia Consumer Service

This is a service based on a mass market consumer who using the Media Portal Package, who principally wants access to media products – to be able to have video on demand, games, download and share music and video files etc. For customers with PDAs and PDA+/Webtablets, in car entertainment, wire-replacement home systems or possibly maxi-phones. This is a product that an operator could provided to a content or entertainment brand reseller, Mobile Virtual Network Operator (MVNO), or as part of an operator-branded entertainment service.

7.4 Emergency Service Communications

This provides radio, data and video communication between emergency service workers and their control bases (fixed and mobile). It requires reserved channels, and priority access in certain circumstances. There will be corporate (government) negotiation of terms, and relatively low number of users. It must work in a wide range of locations, but also respect sensitive equipment in operating locations such as hospitals. The emergency services tend to have their own systems, for example, Terrestrial Trunked Radio (TETRA), but multi-bearer services that can simultaneously use public networks or other private systems may become a future requirement.

7.5 Independent Business Person's Service

This is a service for people who work from a car, other people's offices and home, and run their own business. They need to be in touch all day and night, send clients information, conduct marketing and all the usual business activities, while on the move. They use the mobile office version of the Network Supported work tools. This product provides office Internet access, multimedia calling, file transfer, location service etc. These customers can pay for a premium service, as they may also use it as a wire replacement, and have a high reliance on receiving a high quality of service.

7.6 The City Dweller's Service

This service is for the urban dweller – a chatterer or a commuter - who uses the City Survival Kit or Personal Networker. It offers messaging services, and voice calling, basic Internet access for access to network applications such as banking, shopping, travel information etc, and location services. The service is for urban use, and is not expected to perform in rural areas. This user will probably pass though hotspot areas frequently, and require service in offices, public spaces and outside.

Of course this is not an exhaustive list, just some suggestions from the small number of context scenarios. It demonstrates how some generally accepted service products, such as

mobile VPN connectivity and simple rich voice can be found though the scenario method, and also the identification of service products such as the city dweller and independent business person

8. Conclusions and Discussion

8.1 Communication and cooperation

Social scientists have to struggle to define what they can offer in understanding or shaping the development of new technology. This is especially so for those doing user research. Areas of influence in industry include marketing, system configuration, conceptual design and company strategy. In many of these areas commercial consultants, market researchers and internal researchers are the traditional sources of expertise. The FLOWS project has been unusual in that social scientists are working as part of a research and development team that is not creating end user products, and is indeed not creating anything physical. The social scientists are in a role that is usually taken by engineers who are dipping into user requirements analysis or techno-economic modelling. It is a challenge to find ways to bridge the communication and knowledge gap between research engineers and social scientists.

This project highlighted the significant learning needed to understand the requirements and expectations of the engineers, and the models of users and market that are implicitly used. The scenarios provide the framework for subsequent learning, and although there may not be a great of change in the research programmes, since they are defined in advance, the various technical and social science work programmes can be tied together more closely at the time of dissemination and presentation of results.

8.2 Scenarios for future wireless

This scenario framework provides us with ways to tie a range of user research to the requirements of the engineers, but also opens up an agenda for future social science research. It is clear that certain groups of users, places and devices and uses are very little researched, but will be important. There is a great deal of research on teenage girls, and on certain mobile workers, but much less on a cross section of city dwellers, “non-executive” peripatetic workers, or clipboard professionals such as doctors, vets and engineers. Particular areas of research that could be developed in the future: use of information and broadband on wireless devices; locations of mobility; WLAN hot spots; linking home and public spaces; control of technology and use within particular spaces or among particular groups.

While there is qualitative research on the way people organise their lives, work and relationships, and use ICTs in everyday life, a weakness is in the availability of quantitative data, especially from the operators. Most of the data is rather generic, or gathered from studies of wire-based applications or within the FLOWS study. Of course it is not possible to have data for service and markets that do not exist, but more detailed figures on the emerging patterns of use of different types of users should be available from operators in some form. Even the research departments of operators have difficulty obtaining data from the operating division of their own companies because of commercial sensitivity. However, without this data, for example, on the average number of calls or email downloads of business customers according to different locations and times of day, it is hard to build up the scenarios.

Even though it may appear a little mechanistic, this framework is an important example of the work that needs to be done to systematically draw together qualitative and quantitative work on different people and places, devices and applications and present it in a form that can be quickly turned into scenarios for engineering or service design. It can be used to add depth to the scenarios with reference to supporting research, and build up a library of examples. The user scenarios can also be used as the basis of new user research to investigate people, such as the travelling executive or family on holiday, and the conditions under which they may turn to technology at different points in their lives.

Much scenario work is conducted by engineers, with little knowledge of the large amount of research on use of ICTs, and of the methods and approaches developed to understand the relationship between technology and people. This chapter hopes to provide some useful inputs for those within the industry to incorporate into their work.

9. Acknowledgements

Scenarios in this paper were developed jointly with Lisa Lee at the University of Edinburgh.

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