

Lappeenranta University of Technology
Department of Information Technology

Mobile terminal adaptation in portal for better usability

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ABSTRACT

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Mobile terminal adaptation in portal for better usability

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Electronic financial services, especially Internet banking, are a growth area. Financial service provider must offer high accessibility via all channels. With high accessibility customer can choose his preferred channel at any point of time. Service provider must have a flexible architecture to be able to support customers changing requirements. With flexible architecture, terminal adaptation is possible and service provider can support variety of terminals and technologies easily and rapidly. Terminal adaptation offers clear advantages to the service provider and to customer.

This thesis concentrates on investigating is multi-channel support and terminal adaptation possible in Nordea's forthcoming banking services? Multi-channel support and terminal adaptation should be able to implement with existing new architecture, which have been developed by TietoEnator in co-operation with Nordea.

Good results were obtained by reorganizing page structures. Problems in the current architecture and remaining open questions were identified and listed. It can be clearly seen that efficient terminal adaptation brings advantages to the bank and to its customers.

TIIVISTELMÄ

Lappeenrannan teknillinen yliopisto

Tietotekniikan osasto

Teppo Jansson

Portaalin mukautuminen langattomaan päätelaitteeseen paremman käytettävyyden vuoksi

Diplomityö

2004

70 sivua, 32 kuvaa ja 1 taulukko

Tarkastaja: Professori Jari Porras

Hakusanat: Langaton päätelaite, mukautuminen, portaali, käytettävyys, elektroniset pankkipalvelut

Elektroniset finanssipalvelut, erityisesti Internetin kautta käytettynä, on kasvava alue. Elektronisten finanssipalveluiden tarjoajan tulee pystyä tarjoamaan laaja käytettävyys kaikkien kanavien kautta. Laajan käytettävyyden avulla asiakas voi valita haluamansa kanavan haluamanaan aikana. Palveluntarjoajalla tulee olla joustava arkkitehtuuri pystyäkseen tukemaan asiakkaiden muuttuvia vaatimuksia. Joustavalla arkkitehtuurilla päätelaitteeseen mukautuminen on mahdollista ja näin palveluntarjoaja pystyy tarjoamaan tuen monille eri päätelaitteille ja teknologioille helposti ja nopeasti.

Diplomityö keskittyy tutkimaan mahdollisuutta monen kanavan tukeen ja päätelaitteeseen mukautumista Nordean tulevassa finanssiportaalin ratkaisussa. Tämä pitäisi olla mahdollista uuden arkkitehtuurin kanssa, jonka TietoEnator on toteuttanut yhteistyössä Nordean kanssa.

Sivujen rakenteen uudelleenjärjestelyillä saatiin hyviä tuloksia. Nykyisestä arkkitehtuurissa löydettiin myös puutteita ja jäljelle jäi avoimia kysymyksiä, jotka kirjattiin ylös. On selvästi nähtävissä, että tehokas päätelaitteeseen mukautuminen ja tuki monelle kanavalle tuo hyötyjä sekä pankille että asiakkaalle.

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ABBREVIATIONS AND TERMS

ATM	Automatic Teller Machine
CIL	Common Integration Layer
Classic	Nordea Finland's current net banking solution
CRM	Customer Relationship Management
CSD	Circuit Switched Data
CSS	Cascading Style Sheets
EDGE	Enhanced Data rates for Global Evolution
GPRS	General Packet Radio Service
GUI	Graphical User Interface
HSCSD	High Speed Circuit Switched Data
HTML	HyperText MarkupLanguage
HTTP	HyperText Transfer Protocol
J2EE	Java 2 Platform, Enterprise Edition
LAN	Local Area Network
MIBA	Mobile Internet Business Architecture
MITA	Mobile Internet Technical Architecture
NG	Nordea's future net banking solution
NG Solo	Next Generation Solo
OMA	Open Mobile Alliance
OTA	Over The Air
PC	Personal Computer
PC browser	Browser used by a PC with a large display
PDA	Personal Digital Assistant
ROI	Return on Invest
SoloWAP	Nordea Finland's WAP service
WAP	Wireless Application Protocol
WCSS	Wireless profile Cascading Style Sheets
WML	Wireless Markup Language
XHTML	eXtensible HyperText MarkupLanguage

1 INTRODUCTION

Electronic financial services is a growth area, especially Internet banking. With high accessibility, integration and efficient business processes in all channels, any company can ensure the highest customer satisfaction. High accessibility is very important because it is the customer who chooses his preferred channel at any point of time. When services support the mobility and convenience of customers, wherever they are, whenever they need them, whatever need they have, the highest customer satisfaction can be achieved. However customers are not the only party that gain advantages because also companies get clear cost savings from e-service transactions. [EST00] So there is clear win-win –situation between the e-service provider and the customers.

Nordea, a world leader in Internet banking, and in e-commerce, and TietoEnator, one of leading suppliers of high value-added IT services in Europe, are together developing new net banking solution. This solution will expand the range of services to be offered to customers and will bring the existing separate net banking systems operated by Nordea within the same framework. Internal name for the development program is Next Generation Solo (NG Solo). It is an online bank that will be a full-service customised financial portal. It will offer customers individually targeted services that are best suited to their life situation at any given time. One goal for the new banking solution is that with it time to market duration in supporting some new gadget or technology comes shorter. By doing this Nordea can start supporting these gadgets or technologies easily and rapidly and this way show that it is a leader in e-banking. [EST00], [NOR03], [SOL01], [TIE01]

Originally NG Solo will only support browsers used with a Personal Computer (PC) and with a large display (PC browsers), but also support to mobile terminals will be developed. Almost all possible terminals can be supported, because all back-end applications are the same, front-end applications should also work the same way in every channel. This way user knows how to use the application with any device, because it works identically every time. An example of this could be a user that has been using Nordea's banking services with a PC browser and then starts using mobile services with a mobile terminal. After changing his terminal, he does not need to start practicing new things because he has been

using Nordea's banking services earlier, for example it is intuitively clear to the user how to make New payment in every terminal. This is possible, if the workflow is always the same.

Goals of this Master Thesis are to clarify and investigate, is it possible to use same architecture than NG Solo in supporting number of channels and terminals? When supporting different kind of terminals the idea is to use terminal adaptation, so applications will appear differently in different terminals. When terminal adaptation is done well enough it brings advantages to the service provider and to the customer. The service provider can add a channel or a terminal easy, inexpensive and fast. The customer can use the same service with number of different terminals and the service looks the same respect to features and limitations of used terminal, which affects increasingly to the usability and to the user expectations.

2 ARCHITECTURE

The evolution of mobile applications will not only be dependent on the framework of the future technologies, but also depends on possibilities and limitations of the existing back-end systems. Architecture is very important, if not even most important element in the application design. However concept of the architecture is so large-scale that in this chapter it has only described some important things that are related to development of multi-channel portal, which is accessed by many different devices and combines many different legacy bank-end banking services. It is important to remember that a good (mobile) service is not depended on the technology behind the service, so despite which standards are used, success will be based on a smart design, a strong brand, enhanced services, and to the ability of listening to the customer's needs. [NEX03], [PAA01]

2.1 MITA methodology

Nokia has created a methodology called Mobile Internet Technical Architecture (MITA) whose approach is openness and interoperability. [MIT01] This is shown in Figure 1.

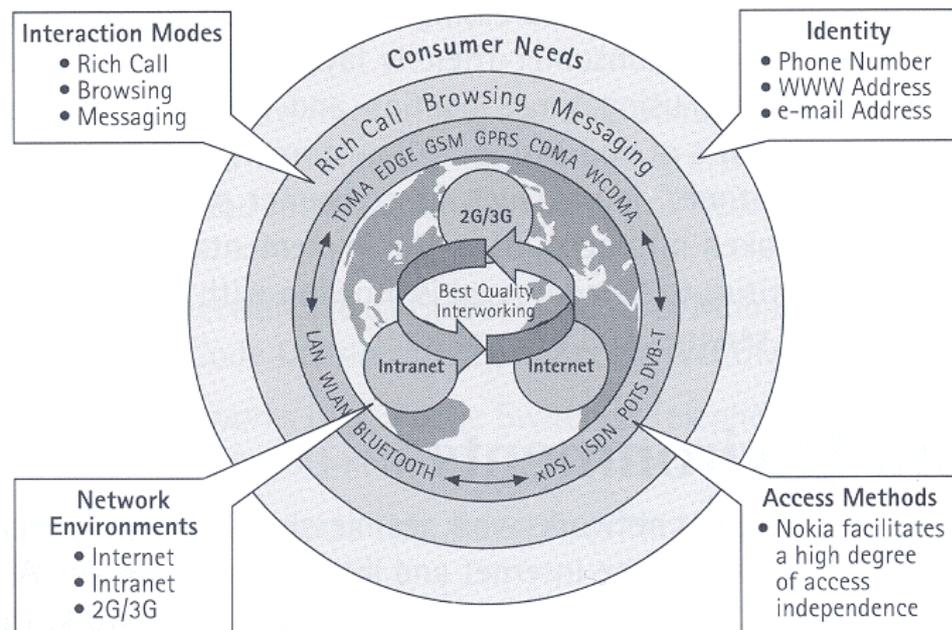


Figure 1. Mobile Internet Technology Architecture elements. [MIT01]

With the help of this methodology, it is possible to model the new environment and understand the technical issues inherent in building the optimal technical architecture. This is achieved through abstract models, which describes a conceptual framework for the environment in progressively more detail and highlights the challenges of interworking between them. Tools for this are architecture modelling principles, architecture concept models, architecture implementation models, and architecture specifications. [MIT01] This could be explained so that the customer always needs something from some sector. If these sectors work well and together, customer gets what he wants and he is satisfied.

With the help of architecture modelling principles, it should be possible to create a future proof end-to-end architecture with high possibilities for modularity of constituencies in the technical architecture. Following principles dictate that layered models are applied to element design, network modelling, and identity structuring:

- Architecture is divided into independent sub-architectures while fulfilling business needs.
- Architecture is open, modular, and hierarchical.
- Architecture can tolerate varying rates of technological change in individual components. [MIT01]

Architecture concept models can be divided into two different models. From a business architecture point of view, there is Mobile Internet Business Architecture (MIBA) and for a more technical approach there is MITA. MIBA defines the interaction between different architecture elements, which can be seen from Figure 2. [MIT01]

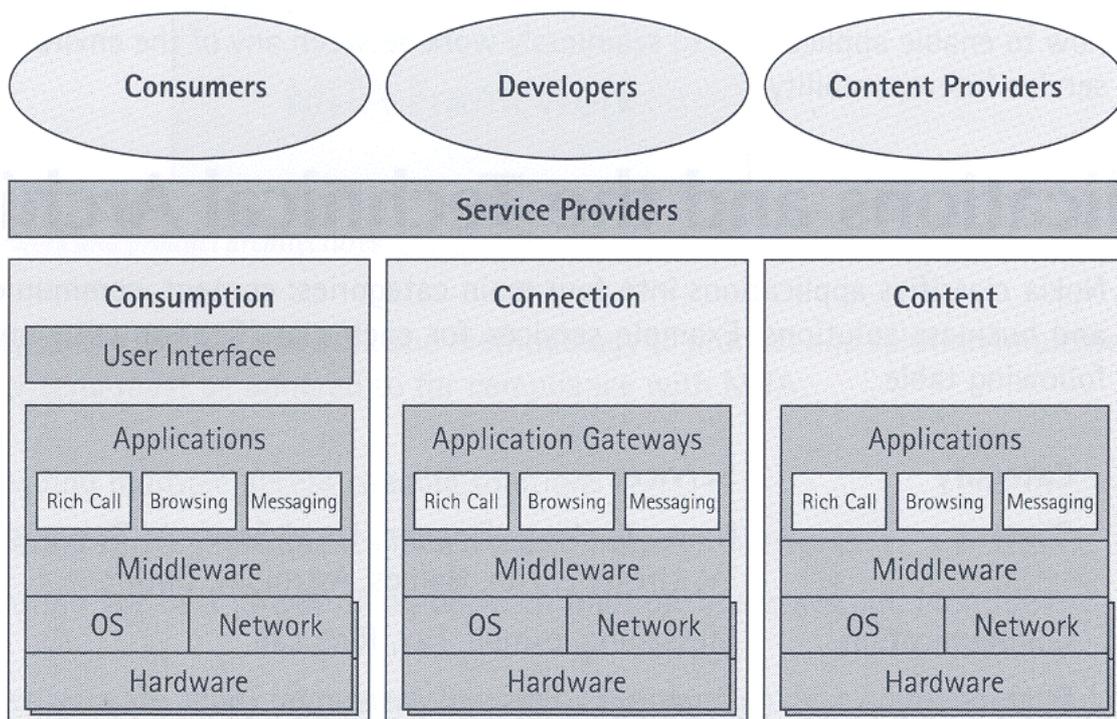


Figure 2. Mobile Internet Business Architecture. [MIT01]

In this model, the terminal segments provides the end-user with access to services, the network segment provides terminals with connectivity to service networks and the last segment, server segment provides content and services for the end-users. In each layer (consumption, content, connection) MIBA approach models each interacting entity as an element that can be described as consisting of three abstract layers: application, middleware and platform. By mapping the MITA element to the MIBA concept model, an end-to-end view of MITA is achieved, which is high-level reference model for more detailed technical architecture design. In principle, it identifies all the elements of MITA that can be derived from the same baseline MITA element. [MIT01]

Architecture implementation models introduce an implementation view of the technical architecture, which enables flexible evolution. A primary requirement is that an implementation of any subsystem can be replaced with another implementation having a minimum or zero amounts of modifications into other subsystems or applications that utilizes the services of the replaced subsystems. Also some subsystem's technology can be changed completely without influencing other related subsystems. [MIT01]

Architecture specifications can be divided into three groups:

- Architecture specifications have a permanent nature.
- Key system specifications represent issues where an understanding end-to-end system aspect prior to technology is important.
- Architecture frameworks, which includes frameworks for complicated issues like security. [MIT01]

2.2 Service-oriented architecture

Main idea in this service-oriented architecture is that services are being used for some application; service 1 (S1) does this and service 2 (S2) does that and so on as shown in Figure 3. These services act as “black-boxes” where something comes in and after that, needed results will come out. [KAN03]

Service orientation does not refer to a technology or expect an implementation mechanism and because of that this kind of approach would pay substantial dividends for an organisation when the market or business context changes and it leads to infrastructure changes. So this architecture is more based on business than technology. The supporting infrastructure of each service can be assessed individually and this makes possible to use this approach with multiple legacy systems. [BAR03], [KAN03], [PER03]

Service-oriented architecture is the base for multi-channel architecture. Basic idea of multi-channel architecture is shown in Figure 3.

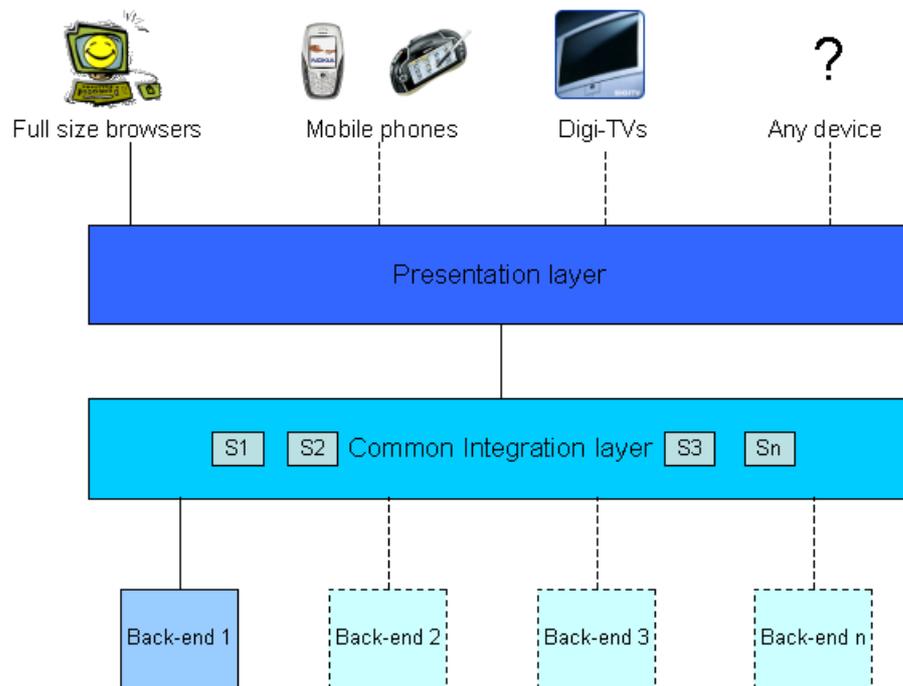


Figure 3. Service oriented architecture is the base for multi-channel architecture. [KAN03], [MCA03]

The idea in this architecture is that one Common Integration Layer (CIL) includes service interfaces to legacy back-end systems. These service interfaces then include technically controllable mechanisms, which use different services. All existing and new services will provide their interfaces through the CIL, thus providing access for multiple channels, and so these services have to be done only once. [KAN03]

Presentation layer is between the CIL and different channels. This layer takes care of presenting the content to different devices and contains use case specific business logic. It does not involve any other business logic, which is situated in the back-end systems. So presentation layer does not do any banking services but it connects to the CIL, which then connects to back-end services where banking services are done. Because presentation layer includes use case specific business logic, it can be used for checking if some information is correct, for example in New payment that due date is set to the future. This can be done without information from the back-end services, so applications will not get so complex. [KAN03], [MCA03]

Because applications need to prepare to support all kinds of connections, it should not matter if the user uses CSD, GPRS or any other standard for accessing the Internet and service providers' products. This can be done by multi-channel architecture, because new channels can be added easily to connect existing applications. [HIL02], [MCA03]

3 PORTAL

Portal can be defined in a multitude of ways. A quite interesting definition comes from medical science: "The portal system may be described as a specialized portion of the systemic circulatory system. It is unique in that blood from the spleen, stomach, pancreas, and intestine first pass through the liver before it moves on to the heart. 20 percent of the blood flowing to the liver comes from the hepatic artery and 80 percent comes from the portal vein." [ENCY1] Although this is a medical definition to portal, it could be also related to information technology. Like every person who has been visiting some of the many portals in the Web, for example www.msn.com or www.yahoo.com, there is very much different kinds of information for everybody. Therefore personalisation and customisation are very important features in the future portals, because it is difficult for user to find relevant information for them without some filtering. These terms are used differently depending on the used sources. In this thesis these terms are used as described next. [KAS02], [PAA01], [SYBAS]

When a company offers different kinds of services for their customers, depending on customer behaviour or background it is called customisation. Personalisation on the other hand is done when a customer changes some service to be more suitable for him, for example changing start page of some service or giving names to his accounts. [DEV03], [KAS02], [SYBAS]

The reason why Nordea uses these terms this way is simple. During first steps of NG Solo project, one common question was what you mean by customisation and personalisation. Because people understand these terms differently depending on their background, it was just decided that always when talking about customisation, it means bank is customising the portal and its offerings towards customer and when customer is doing something in the portal, it is called personalisation. [NUM03] When developing an application it is important that people who are involved in developing use the same terminology.

3.1 Portal types

Portals can be categorized according to what kinds of services and applications they offer as shown in Figure 4.

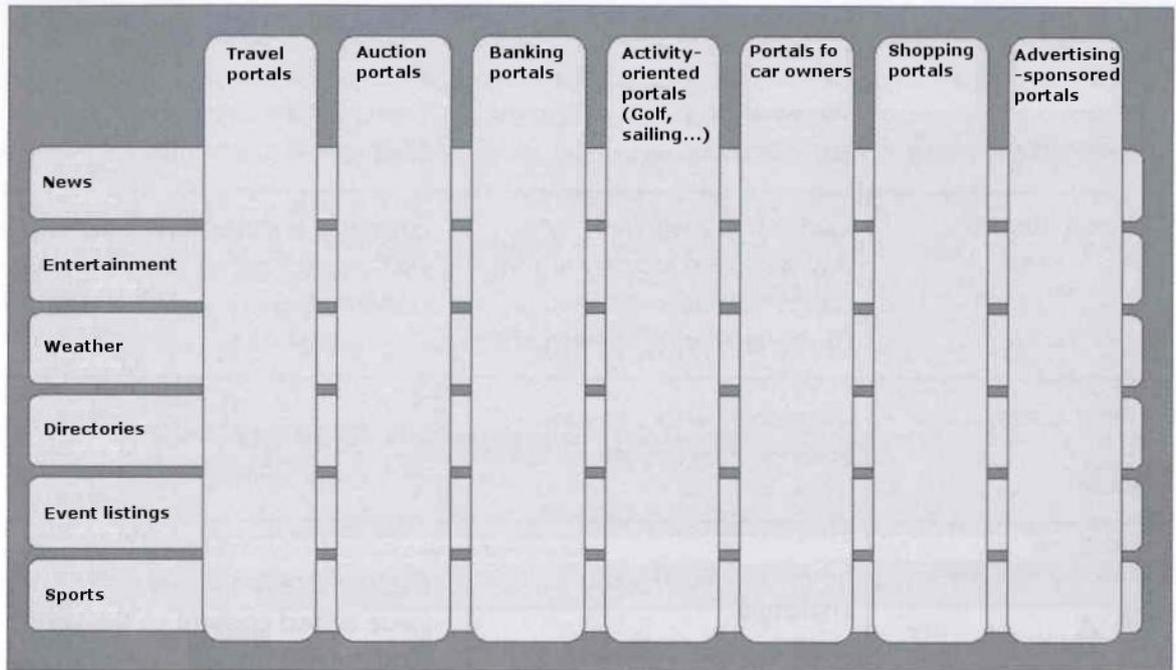


Figure 4. Horizontal and vertical portals. [PAA01]

Each service has strengths and weaknesses, little different revenue models and target groups. Most important is that the portal answers to the needs of the chosen customer. [PAA01]

3.1.1 Horizontal

Horizontal portals have a mass-market approach and a wide range of generic applications, which provide information for users. Mass-market approach is based on the early days of mobile commerce when portals stretched to attract masses when they tried to build a critical mass needed for market domination. Big national or international companies with

economies of scale usually build horizontal portals. These portals have a good potential in becoming a market place for mobile commerce when terminals enable a wider spectrum of features. [PAA01]

Horizontal portals have some problems, which are related to their mass-market approach. They offer general content like news, entertainment and search capabilities to people with different backgrounds. This makes them quite faceless, so without real value to the user, horizontal portals are not able to compete against differentiated services of the market. Because of this, they are in danger of losing some customers if they fail to generate new, innovative services. To avoid this, they have several strategic options in which to choose. Some may obtain vertical content by buying smaller vertical portals. When doing this, the new content should be integrated into the existing services seamlessly in order to maintain a consistent brand image and portals could start expanding into vertical markets and create customer loyalty by providing communities with interest. [PAA01]

Efficient content management is another way to more vertical content. With a good enough content management users are able to create their personal profiles for the service and access the specific topics of interest. The content can come from anywhere, even from a third party. To assure successfulness, horizontal portals should offer personalisation because the wealth of information cannot be accessed conveniently with a small screen mobile terminal, without personalising the user interface. So it can be said that personalisation technology is crucial and inevitable. [PAA01]

Another possibility for improving the customer's experience is location technology. This also generates additional revenue. A massive amount of information can be localized for easier customer interface. Also location-based services could be used for filtering the content and creating a search engine with location-sensitive conditions. [PAA01]

Horizontal portals offer something for everyone. This is their biggest weakness and strength. Without personalisation or location technology it is very difficult to deploy targeted advertisements and services because of the diverse interest and backgrounds of the people. [PAA01]

3.1.2 Vertical

Vertical portals target special interest groups and communities, so their users are usually like-minded. The content is crucial to the customers. Because they are interested in same things, they do not require same kind of personalisation opportunities like the users in horizontal portals. Neither is location-sensitivity as important as with the horizontal approach, for example the user of a financial portal does not demand the information to be location-aware because it does not bring any added value to the user experience. On the other hand, the importance of time sensitivity increases and the user is likely to be willing to pay a premium charge for getting the financial news directly to his mobile terminal as soon as it hits to the market. By doing this vertical portal is able to generate additional revenue from premium real-time services. [PAA01]

Because vertical portals are communities for like-minded people, customer loyalty is high and advertisers are able to focus their message better. Portal providers are also able to deploy niche applications and this way offer more value to customers. When time goes by, vertical portals can be swallowed by horizontal players, which want to increase their customer loyalty by providing community services. By doing this, horizontal portals could overcome their lack of customer loyalty. [PAA01]

3.1.3 Multi-channel

Multi-channel portals combine the benefits of different media and improve the limitations of the mobile channels. Print, TV, radio of the fixed Internet interface can be combined with a mobile channel to overcome the limitations of screen size and text input. The same channels can be used for getting customers, because direct advertisement in the mobile environment may not be very efficient. [PAA01]

An Internet portal combined with mobile channel can be a strong combination. A mobile portal can be personalised using a PC browser and other services can be made accessible

from both channels. This way, user can use services regardless of time and location and importantly he may use the most convenient channel in different situations. A multi-channel approach enables numerous revenue generating services. Advances in multi-channel portal are that the limitations of screen size and text input can be overcome. The key to success is to embrace the natural characteristics of mobile devices, which are time sensitivity, location independence, personal manner and impulsive use. [PAA01]

3.2 Strategies

Creating a mobile portal requires a variety of skills and capabilities. Players in the value chain, which is illustrated in Figure 5, have their own core competencies that they count on when planning mobile ventures. Their position in the value chain has also an effect on their success. Players, who do not have a direct customer contact, have to move in position where it becomes possible or to develop partnerships with companies, which have it. On the other hand, companies with a direct customer interface may be in danger of losing it because of the dynamic markets in the mobile Internet. If some player in the value chain fails to follow usage patterns and the development of the new technology, there is a chance that some players will take their place. [PAA01]

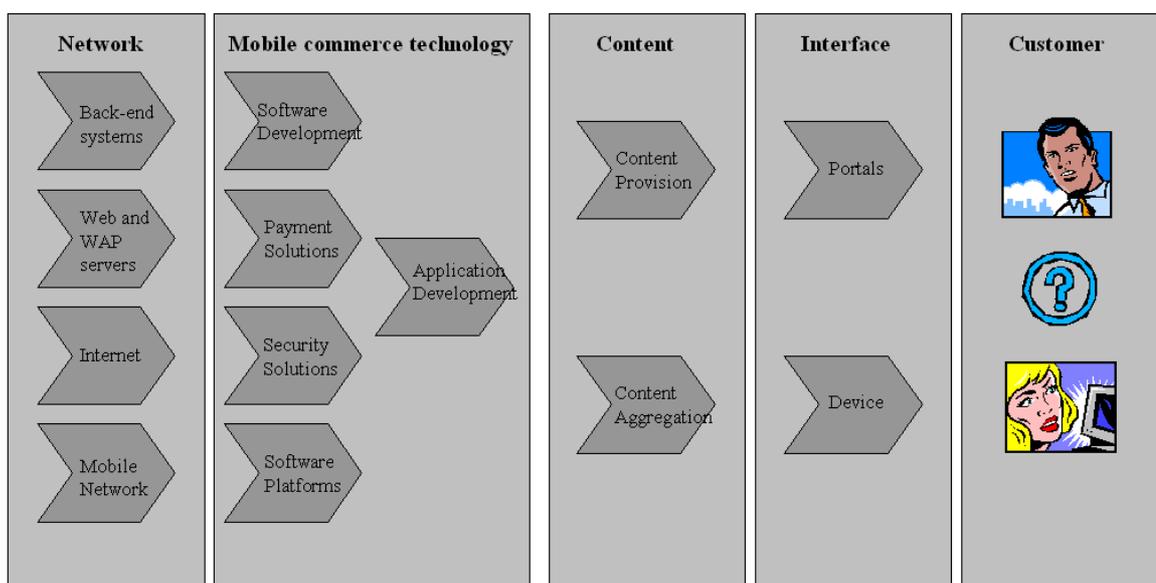


Figure 5. Value chain of mobile commerce. [PAA01]

Any player in the value chain is not able to produce all services by themselves and because of this partnerships and joint ventures are inevitable and even recommended. Different kinds of companies are looking for partnerships in order to reduce the time to market and acquire capabilities and knowledge they need for successful market entry. There are four different partnerships that are needed in mobile portal development and their main goal is to create a win-win –situation. These are:

- *Technology co-operation*, the finding of technologically feasible solutions.
- *Synergy strategies*, the building of critical mass and economies of scale.
- *Content co-operation*, for example linking content to different kinds of services.
- *Control strategies*, getting better control over the value chain. [PAA01]

Almost all players in the value chain need technology co-operation. Linking different players together is an enormous task and system integrators are in a key position to provide their services. Needed technology is complex and requires real-time connections among the producers. Success in mobile commerce will be granted to companies, which provide basic infrastructure and system integration to the various players in the value chain. [PAA01]

Companies establish partnerships with their competitors or with other players in the value chain to acquire critical mass and economies of scale. Examples of these partnerships can be that content providers join together to be able to compete against strong brands in the same field. Financial institutions and mobile operators can co-operate to combine their customer base and provide horizontal portal services for everybody. Banks and insurance companies are looking for synergies when entering into mobile portal business. [PAA01]

Content is one of the basic components of successful portal and companies are looking for ways to differentiate from their competitors. Players who have only little content need to seek partnership with companies that are able to deliver information services. For example banks are interested in doing content co-operation with content providers because banks do not have a wealth of information but they still want to establish mobile portals. [PAA01]

Control strategies are important for some players because without those they are likely to be disintermediated from the value chain, if they are not able to find suitable partner. Mobile operators, for example have an extremely strong position in the value chain. They control network usage, billing relationships and location information. Because of this, some players are taking direct action to prevent disintermediation. For example banks have basically three main strategies against operators, which offer financial services.

- Co-operation with content providers and device manufactures to establish a mobile portal.
- Establishing a mobile portal with a mobile operator
- Develop financial products, for example debt recovery, for mobile operators offering financial services.

First two choices retain direct customer relationship and the third one creates lose direct customer relationship. [PAA01]

3.3 Actors

Around portal there are usually 4 actors and these actors create mobile browsing value chain. This can be seen in Figure 6.

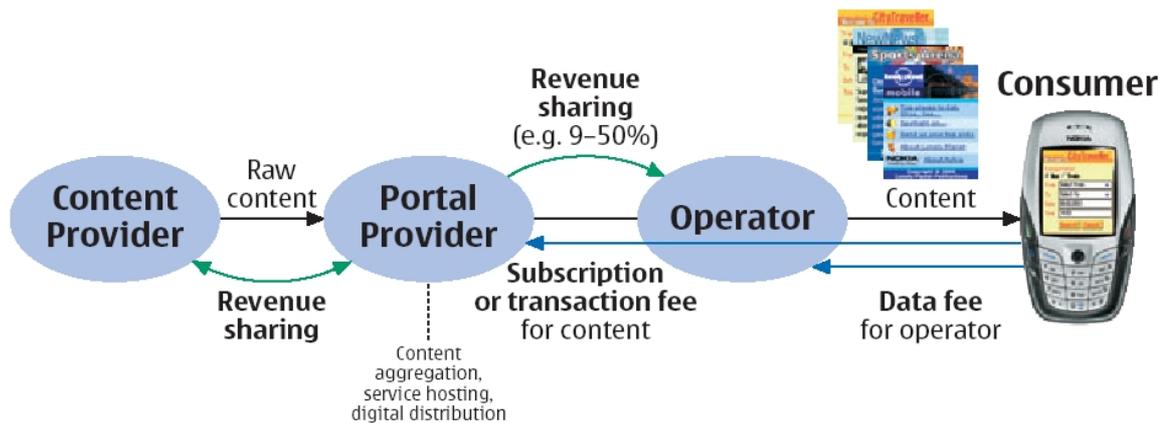


Figure 6. One possible example of mobile browsing value chain. [NEX03]

The actors are

- *Content provider* (for example mobile portal), who is a creator of a mobile web-based service or web site. May also provide actual content for example infotainment, downloadable content, or other web-based data, or provide person-to-person services such as chat or e-mail.
- *Portal provider*, who is an optional 3rd party managing the aggregation of service content, business and technical relationships with content providers, and packaging and marketing of services for end-user segments. This can be a function of the operators separate division, which is responsible for provisioning and delivery.
- *Operator*, who delivers mobile web content from content providers to users. Manages user billing and delivers value-added service to content providers, for example authentication, location and push-services.
- *Consumer*, who is the ultimate source of all revenue. In this model consumer is the direct source of data fees, monthly fees, and premium service fees. [NEX03]

3.4 Walled and Open gardens

There can be two different kinds of portals, walled gardens and open gardens. Walled garden means, that portal provider provides organized, uniform access to high quality services designed for mobiles only through its portal. This can be compared to current situation in WAP-services. Operators grant only access for their customers to their services and they can block access to some 3rd party services. In Finland, for example there is a situation where operators do not allow anybody else in their portal except their customers. In open garden the operator provides high quality, well-organized, and personalised content and services within the portal, just like in walled garden. The difference is that users are also free to access open mobile web content as in the Internet model. Mobile portal also provides user to search the whole web, so open garden is most efficient in partnership with a mobile search engine, with a way to adapt or filter results based on suitability for the target device. [NEX03], [WAPRL], [WAPSO]

3.5 Revenue models

At the moment traffic means revenue for the operators, so by increasing traffic is the surest way to increase revenues. All kinds of services create traffic, like operator-provided services, licensed services, and open Internet services. [NEX03] Operators benefit most of these increased services because they provide all the traffic, so they also get all revenues. Instead portal and content providers must come up with different ways of getting revenues to cover development costs. Next is some different revenue models presented.

In 3rd party mobile services the cost of developing a mobile web site must be offset by sufficient revenue to provide enough satisfying Return on Invest (ROI). In up-front license fee content development is paid up front by the operator in a shape of development fee or fixed licensing fees. This is quite risky for the operator, since an unsuccessful service will still cost the full amount. For the developer this kind of revenue should be encouraged to build services. In shared data revenue license payments are, for example tied to generate traffic to create a win-win situation between operator and provider. This situation is reached by so that operators make data revenue from increased traffic, and pays the content developer more based on the traffic they generate. By doing this content providers are trying to be more creative when looking for a big “hit”, which benefits both. Compared to up-front license fee shared data revenue limits the risk for the operator, because the cost of failure is borne by both parties. [NEX03]

Usually operators charge a monthly service fee for mobile data services. By doing this current subscribers pay guaranteed revenue that can help finance development of mobile portal and its services. Users are also encouraged to use services they have paid for. But for many users up-front fee is barrier to entry, because they do not want to pay in advance for some services that they have not seen yet. Totally different approach for this is to open mobile browsing access for all customers, and to provide so enticing services that users become accustomed to using their mobile browser, and this way increase data traffic. The optimal blend would be hybrid of these approaches: open data access to all users with no up-front fee, but with a relatively high per-unit data charge, and then sell portions of data

for a fixed fee and this way encourage users to get lower rates by committing to spend money. [NEX03]

To make browsing service market really take off, operators need to make sure that mobile users can access third party content. Third party content must attract and satisfy the needs of users, whether they want to show off or just to make life easier. The service must provide its product more attractively than existing rivals. To make it easier for content providers to enter the market and establish a win-win situation between operators and providers is critical. This can be done by ensuring that the mobile is ready to be used as soon as it is purchased, with all required settings in place in the terminal. [HIL02], [NEX03]

During year 2002 several mobile WAP 1.x browsing portals experienced over 100% increase in usage. This can be seen in Figure 7.

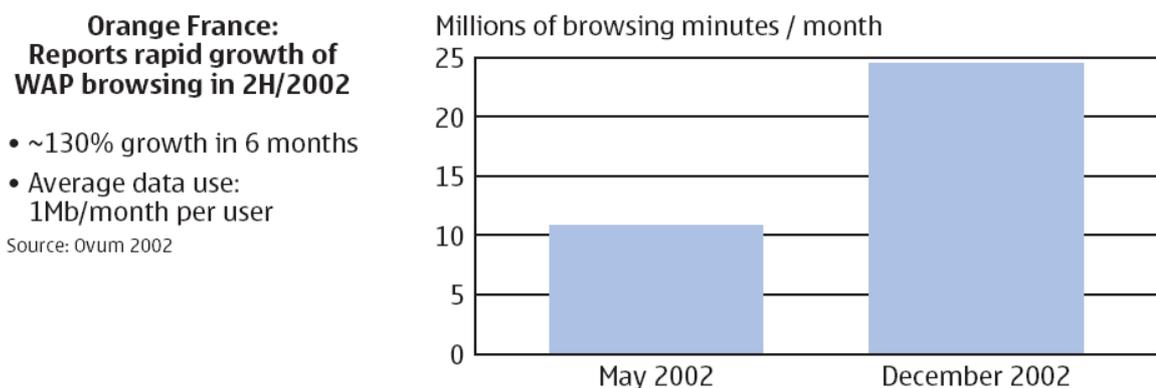


Figure 7. Increase of mobile browsing [NEX03]

Reasons for rapidly increasing mobile browsing are colour graphical user interfaces and instant access over faster packet data network connections. [NEX03]

Based on our own experiences there are still some flaws in revenue models that affect decreasingly to the browsing popularity. Problem for portals and service providers is that there are not good enough payment methods for selling mobile applications, ringtones and logos, because the operators take so great share of the whole sum. Reason for this is the operators' possibilities to suffer high credit losses. On the other hand, operators and service

providers have problems, because there are not good enough billing methods for selling concrete products, meaning for example clothes, TVs, CDs, and so on. Although some banks have handy and popular e-transaction methods that are very useful in the normal Internet world, these methods are usually too complicated for mobile Internet. These problems slow down the use of mobile Internet.

3.6 Users and their expectations

Like in every service, also portals have different user groups. These user groups are innovators, early adopters, early majority, late majority and laggards. The names of the groups describe their attitude towards the products. Innovators are interested in almost any new technology; early adopters are basically interested in the product's unique capabilities. By contrast, the majority of customers are more pragmatic and conservative. They will start using the product if it provides concrete benefits. It can be seen from Figure 8 that groups are uneven in size. Two early adopters groups create only a minority of the whole market. So, for some product to make real markets it must get users from every group; only techies, geeks and visionaries are not enough. [HIL02]

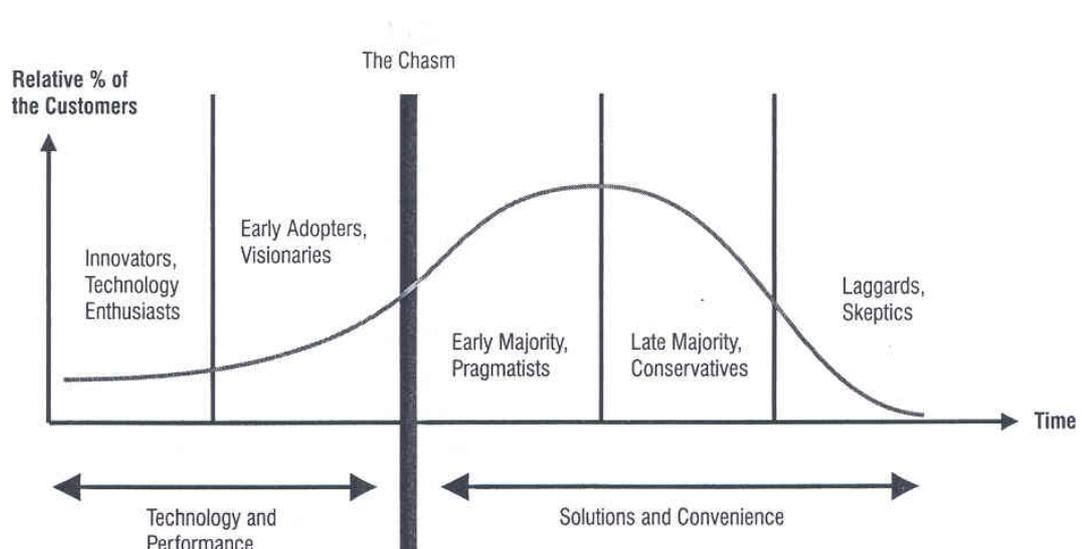


Figure 8. The five general user groups. [HIL02]

The difference in motivation between the early and later user groups forms a chasm. For service providers this chasm is difficult to cross, especially if the product's success has been based completely on the innovative technology. The main problem in this situation is that the users really want a valuable service. They are not interested in the technology, because they just want solutions for their every day problems. This can be done if product conforms to their environment, is usable, provides an attractive set of functionalities for real life needs, is aesthetic and is available when expected. To make some product really successful, it must make a leap from the early technology-driven users to the more ordinary solution-driven users who value a compelling user experience. [HIL02]

Behind the user experience there is always expectations. In every situation we have some kinds of expectations of what we are waiting. What is likely to happen and what will not probably happen. Sometimes these expectations are more accurate than at other times, but they usually match reality better and better as experience with similar situations increase. Most interesting part of expectations towards the user experience is that they have a powerful influence on how we feel about things. Basically, expectations are built on user's previous experience with the same kind of service. Also our expectations are affected by what we hear about a service from our peers or from the media. [HIL02]

3.7 Context of Use

When service provider starts designing a new service, it has a some kind of idea about its purpose, why it wants to bother to carry out design. However, it is very challenging to solve all the problems related to the way the service will be used on the basis of own vision and experience alone. Because of this, all decisions concerning these things need to be based on the knowledge on the use context. Use context is the environment that the service will be used as can be seen from Figure 9. [HIL02]

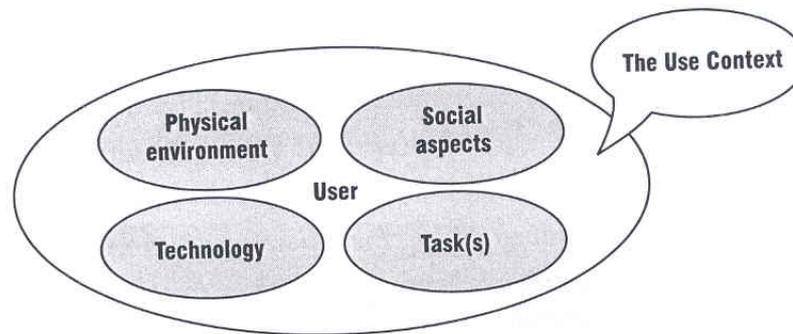


Figure 9. Five perspective of the use context. [HIL02]

These five elements act as moderators and filters through which the “objective” features of the service will be perceived. Example of this is that the same service can appear either funny or frustrating, depending on if the user is in a hurry or not. When designing mobile services, studying the use context is even more important than in desktop environment. Mobile services are used in widely different contexts by different kinds of people, regardless of time and place and with many different kinds of terminals. It should also take into account that people using services have different levels of different kinds of skills, all having an effect on the way they interact with the service. For example, experienced Internet users use the website’s functionality differently than non-experienced users and this should be taken into account when designing it. Applied to mobile phones, the users with earlier experiences with one type of phone will use the mobile Internet through that device differently than users who have mainly used a PDA. In mobile application development this means in practice that the developers of the service have to decide which mobile devices and versions it will support. This information is later essential when the implemented solution is tested and piloted. [HIL02]

4 TERMINAL ADAPTATION

During past years, there has been a proliferation of types of devices and access mechanisms that can use web totally differently than conventional Personal Computer (PC). These access mechanisms range from web tablets, appliances and televisions in the home, to mobile devices including PDAs and mobile phones. Access mechanisms are physically challenging. Connectivity capabilities have also developed, including high bandwidth modems, LANs and wireless networks. Also the needs and expectations of the users with regards to access, availability and consumption of the web content have also evolved. Nowadays users expect to get critical information through different access mechanisms from different locations and at different times during the day. For example some user may want to access some web information using a PC browser connected to a cable network when at home, but when out of the house the same user expects to access the same information using a PDA connected through a mobile phone network. [DEV03]

Content authors can no longer afford to develop content, which is targeted for use via a single access mechanism. The most challenging thing is to enable their content or application to be delivered through a variety of access mechanisms with a minimum of effort. Implementing a web site or an application with device independence in mind could potentially save costs and assist the authors in providing users with an improved user experience anytime, anywhere and via any access mechanism. This way content author ensures best browsing experience for the users. [DEV03], [NEX03]

In next three sections, the impact of device independence is considered from different perspectives. These are:

- the user who wishes to access a web page,
- the authoring techniques used to create the page, and
- the delivery mechanism which made the web page available. [DEV03]

4.1 User perspective

The Figure 10 shows the key user-related concepts.

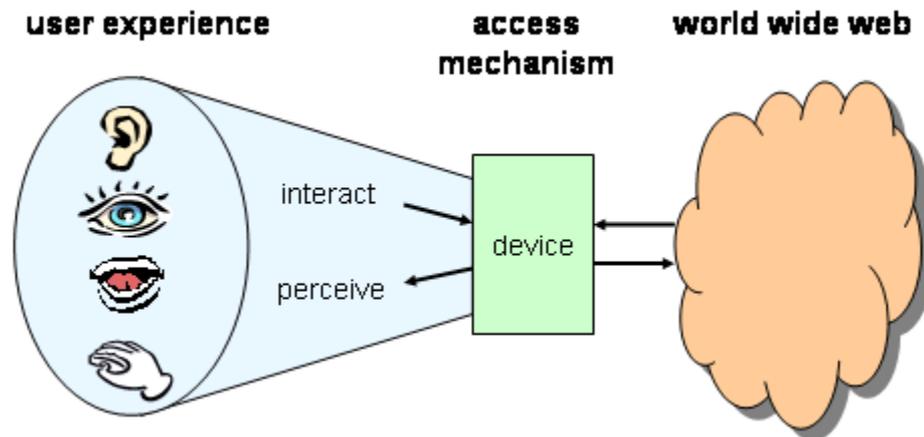


Figure 10. The key user-related concepts. [DEV03]

It is important to enable the user to perceive and interact with the Web using many kinds of access mechanisms. [DEV03] Picture related concepts are defined and explained below.

- *User experience* = a set of material rendered by a user agent which may be used by a user and with which interaction may be possible.
- *Device* = an apparatus which enables the user perceiving and interaction with the Web, for example a PC, a PDA or a mobile phone.
- *Access mechanism* = a combination of hardware and software that allows a user to perceive and interact with the Web using one or more modalities (sight, sound, keyboard, voice, etc.) The access mechanism is an intermediary between the Web and the user. On one side it communicates with the Web using protocols and markup languages, on the other side it supports perception by, and interaction with, the user. [DEV03]

4.2 Authoring perspective

From Figure 11 can be seen the key authoring concepts.

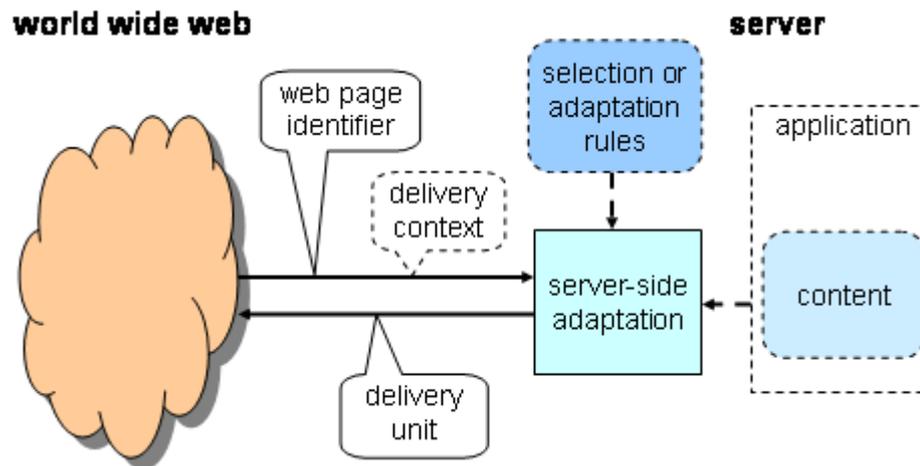


Figure 11. The key authoring concepts

When a request is made over the Web for a web page, not only should the request specify the web page identifier for the page, but also it should provide enough information about the access mechanism and the user. This way it is possible to provide right kind of user experience. [DEV03] The main concepts for authoring are described below.

- *Perceivable unit* = a set of material which, when rendered by a user agent, may be perceived by a user and with which interaction may be possible. Most perceivable units provide both presentation and the means for interaction.
- *Web page identifier* = a Uniform Resource Identifier intended to be recognized by a user as representing the identity of a specific web page, for example “www.nordea.com”. A user can enter a web page identifier explicitly as part of their interaction or may indirectly follow one by selecting a link, and so on.
- *Delivery unit* = a set of material which is transferred between two cooperating web programs as the response to a single HTTP request. The transfer can be, for example between an origin server and a user agent. Users are not normally aware of individual delivery units.

- *Delivery context* = Expresses the capabilities and preferences that may constrain the acceptable range of user experiences that can be delivered via a given access mechanism. In particular, the capabilities of the device, including the modalities and representations it supports, the characteristics of the network over which delivery occurs and the preferences of the user will all potentially affect the user experience provided.
- *Adaptation* = a process of selection, generation or modification that produces one or more perceivable units in response to a request uniform resource identifier in a given context. Adaptation is shown in this figure like it occurs at the server (server-side adaptation). It can also occur at intermediate points in the delivery chain, or at the client (client-side adaptation). There are many different techniques that could be used to produce an appropriate user experience in response to a request for a web page. [DEV03]

4.3 Delivery perspective

The Figure 12 shows the key delivery concepts.

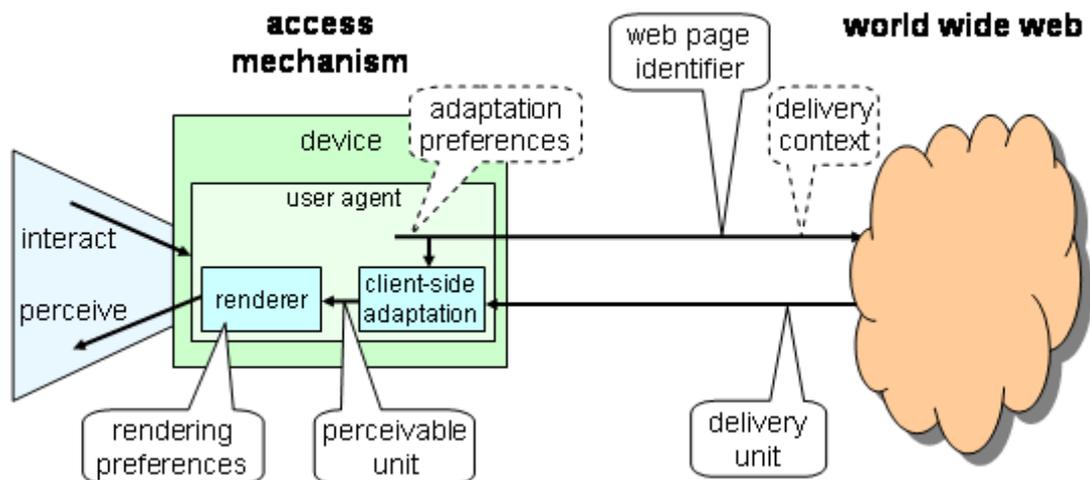


Figure 12. The key delivery concepts. [DEV03]

The main concepts are:

- *User agent* = a client within a device that performs rendering. This is a software or a firmware in a device that lets the user identify a web page to be rendered, assembles an appropriate request for that page (including delivery content), accepts the reply (delivery unit) and renders that reply into one or more perceivable units. Before rendering, a user agent may apply client-side adaptation, usually under the control of adaptation preferences, to transform a delivery unit into a perceivable unit.
- *Rendering* = the act of converting perceivable units into physical effects that can be perceivable by a user and with which the user may be able to interact.
- *Rendering preferences* = a set of preferences, specified by a user, that may affect the way the user agent renders a perceivable unit, and so change the user experience. These are for example increasing size of text or converting text to speech.
- *Adaptation preferences* = a set of preferences, that may affect the adaptation for a given delivery context and so change the user experience. The user may want to be able to express preferences that affect the way the content or application functionality is presented when there is more than one choice. An example of this kind of behaviour could be when access mechanism supports images but the user prefers to receive all information as text because he is using a local text-to-speech converter. By indicating an adaptation preference for no images, the adaptation process may be able to provide a better text-only presentation, harmonized with the delivery context that could be achieved by locally replacing all image by their text alternatives.
- *Application personalisation* = a set of factors which are specified by a user or other aspects of the delivery context, that may affect the functionality of an application, independently of its adaptation and delivery and so change the user experience. Personalisation may include, for example, the preferred language or the preferred location and this way offer better user experience. [DEV03]

5 USABILITY

Usability can be understood at least by two different ways: is it possible to use some application, in other words is application ok and running or how user and application are co-operating together and how pleasant some application is to use. In this chapter we concentrate on the latter one.

Usability is a method- and theory field where user and device's co-operation is tried to get as efficient as possible and pleasant to use. Jacob Nielsen defines usability to be a part of product's feasibility. He states that a good usability is formed in usage by learning ability, correctness, remembering, efficiency and satisfaction. ISO 9241-11 standard says that usability is an important consideration in the design of products, so that users are able to work effectively, efficiently and with satisfaction. These two definitions of usability are most common. [ISO98], [SIN02]

If usability is not taken into account in design phase, it is possible that product have features that reduce effectiveness, efficiency and / or satisfaction. When this happens, a relatively expensive purchase can be useless. For buyer, this causes a need of purchasing a new product and for seller it causes a product that does not have demand and it weakens reputation. [SIN02]

Product should support as well as possible tasks, which it is meant to support. In the Web it is very common that the service providers do not know how the users want to interact, it is even so that they do not know who the users are. [SIN02]

5.1 Use of a product

When human acts, he has some goal where he aims at or in outside world is something that starts the action. In every action that has a goal can be seen three basic stages. These stages are: setting a goal, committing an action and checking influence or evaluate action using feedback. Use of a product is rarely anybody's goal. Product is a medium, which helps user

to achieve his goal. For example, when withdrawing money from the ATM the goal is to get money, not use of credit card or use of ATM. Credit card and ATM are just media that help the user to achieve his goal. [SIN02]

When trying to understand human action, it is very important to understand human's goals. Also understanding medium is important, user interface designer should always clarify for himself which is which actions purpose, what goals user does have when they come to this window or take this object to their hand. To be sure that product is not totally useless, always should keep in mind a goal in which users are aiming at. [SIN02]

Sometimes it is practical to describe usage of a product by semantic and syntactical level. In semantic level there are described product's content facts like mutual hierarchy between user interface objects and functions, significant learning and user's mental models. Description of semantic level is independent from the product. Syntactical level explains how functions and objects are implemented. For example layouts of product or view and usage of mouse and keyboard belong to syntactical level. It requires one or more syntactical action to make one semantic action. User must first know syntactical action before he will be able to learn any semantic actions. [SIN02]

When committing an action, user can make sometimes mistakes; he acts like he should not act. User committed mistakes are divided into two different groups: actual mistake and a slip. Actual mistakes usually result from wrong information or facts interpretation, wrongly generalized facts, choosing wrong action or wrong argumentation and so on. Slips are situations, which are understood, and the intention is right, but it is executed wrongly. Typically these kinds of situations are caused for example by wrong manual input (when using a www-application user clicks different link that he was intended to) or action state mistakes (user makes the right thing, but product is in the wrong mode). Slips usually happen when usage of a product is known well and using of a system is automatic. These are typically easily seen and can be corrected. [SIN02]

Recovering from mistakes takes time and mistakes frustrate the user but in the best cases incorrect action teaches the user. This requires that the user makes mistake in that kind of a

thing, which is logical within the product. If user makes a mistake because a product just happens to work that way in that particular area, understanding the mistake do not help understanding the mode of action at all. Mistakes that are caused because of designers' illogical behaviour or that design directs the user to delusion are taken away from product by qualitative usability tests. [SIN02]

Evaluation has two meanings: to clarify can or must do some action and were the goals fulfilled. When using a product it is clarified:

- *Start feedback*: in what state the product is and what can or must be done to get to the goal.
- *End feedback*: is system working like it should and is the desired goal already achieved.

End feedback should be clear and direct consequence of what the user is doing. End feedback is also next phase's start feedback like shown in Figure 13. If a product is new for the user and although product's previous phase's end feedback and next phase's start feedback is same meaning that product's condition is same, user concentrates first to see previous phase's end feedback and after that start looking function possibilities for next sub-goal. [SIN02]

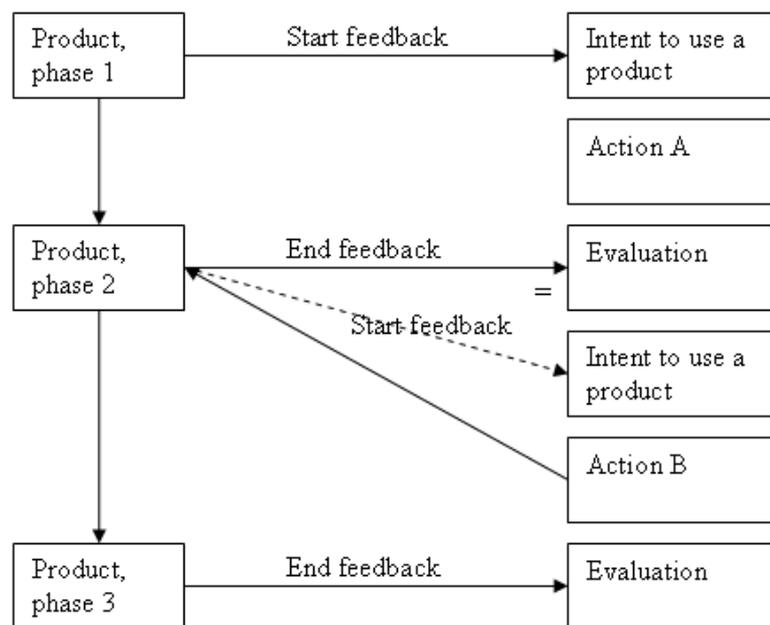


Figure 13. Feedback-Action-Feedback chain. Previous phase's end feedback is always next phase's start feedback. [SIN02]

Feedback can be internal or external. In internal feedback the user is evaluating his own actions and in external some other person evaluates user's actions. The best feedback from some action is always that when process goes on like user expects and he gets nearer to his goal. If user does not get any feedback from his actions, he easily repeats some action, because he assumes that he has done something wrong or badly. If feedback is negative, user interrupts or cancels the action. [SIN02]

Feedback is a prerequisite for all kinds of learning. When internal feedback is negative, action is understood as incorrect or imperfect. A reason for negative feedback can also be that the action is right but the product is just in the wrong mode. When feedback is positive, the user gets stronger idea of a product's right mode of action. Positive feedback is important when product's right way of use is practiced and when aimed to repeat right mode of action. Negative feedback is especially important when trying to understand the product's mode of action. If user does not stop and consider why his assumption of usage of a product was wrong, negative feedback does not have any meaning. [SIN02]

5.2 Interaction

In a good interface layout, it promotes a product's abstract content and creates uniform entity of the product. Product's elements (keys, displays, headings, texts and controls) and also "unused surface" are important parts of the user interface. Interaction between user and user interface are based on that user can read designers sign language. In the GUI-systems users have learned that certain symbols mean certain function possibility and when he sees this, he knows how to act. In web pages more texts are used to explain different kind of behaviour but also the same kind of symbols that in the GUI-systems are used. Symbolic language in the web pages can be freer than in the GUI-systems because with explanation texts can replace lack of symbolic language. In electronic devices buttons and small displays are used and interaction is based mostly on menus and keys. [SIN02]

When doing visual designing for the product it is very important to take into account an interaction. In visual design bright and mono-concept design it is very important because it helps a beginner to perceive systems and replies to user's assumption of reality and helps visibility of important signals. Interaction within a product usually proceeds with help of feedbacks. How difficult it is to conclude which action must be done to get to preferred goal is called the gap of implementation. This defines how difficult it is for the user to conclude what must be done and how he can do the actions with the help of the start feedback. How difficult it is to know if preferred action has been done right is called the gap of evaluation. In a good user interface these two gaps do not exist. Designer has some ways to prevent these gaps, for example good and bright visual design which has been used for action possibilities of start feedback, usage of conventions, usage of constraints and analogies. [SIN02]

One way to create interaction between product and user is to use different action states. User sets the product to desired state or product itself ends to needed state without user knowing that. These kinds of behaviours are important in small devices, which have for example 5 different keys and PC's intelligence. This means that the same keys mean different things depending on what the user is doing. There are some possible problems with action states. These problems occur, when the user cannot see or presume what state the product is. Other problem is naming of keys, so that name would be rational in every state. [SIN02]

Analogy means that parts of the product or layouts respond to the user point of view of the world. Analogy is very close to significance. If things are displayed in that order that the user thinks they should be displayed, their order most probably responds to point of view of the world. This is very important because for example in WWW-pages, if administrators do not know what the user is doing and why he is using the pages, most probably no users will come to those pages. When the user does not find what he is looking for, usually reason for this is that logic of pages and user point of view do not match. When this happens, user leaves the page or if he must use it, it leads to bad stress. Significant on the other hand means that user has some kind of significance of the task. Humans remember

better things that have some significance to him than things that do not have any significance. [SIN02]

Visual design has a very important meaning especially for new users. By doing it well, it also affects effective usage of the product. Designing screens well and developing its visual features, working speed increases by 20-40 percent. Aesthetic, pleasing system is essential but visual design is more than choosing right colours and systems sketching to be harmonic. Most important is the content and the functionality in user interface. Kevin Mullet and Darrell Sano have defined 3 basic rules on how to design product's appearance:

- Product's elements must be part of the same visual system so that product is designed as a whole.
- When designing a product must take into account where and how user's attention is aimed at certain time.
- Product must fit to the interaction it is used to. [SIN02]

5.3 User consideration and problem solving

Common problem solving methods are usually enough at the beginning of product usage, although sometimes old knowledge disturbs learning. Reason for this is functional association. This means that when someone is trying to find new and more creative method to solve a familiar thing, old mode blocks finding of new methods. This is most probably the reason why the users seize upon old methods even if there would be smarter way of doing things. This is not entirely bad thing because it might be more efficient to use old method so long when it is feasible than to look for a new mode of action. [SIN02]

Analogical reasoning is very a common way to conclude how some product works. Some usability researchers think that the users always use their mode of action with analogy. Using analogy helps user to find usage of a product by comparing it systematically to some old products; this is called learning. Analogical concluding is usually very good when solving problems that the user do not have much knowledge. There are also dangers in

using analogy if chosen product does not work like which it is compared. This leads in a situation that solution might not be found. [SIN02]

When the user gets new product what he should use, his actions include conscious consideration. He must conclude, guess or find systematic mode, which he can accomplish, his goals with the product. He probably has some kind of idea how to start and he tries to find some kind of analogy from his brains. This analogy would be for example same product; product that looks the same or even a product that has same kind of keys or their layout is nearly the same. Usually users seize upon terms. He first inspects product's terminology by going through menus and links looking for the right one. He looks for significant terms that are familiar and fits to his goals. If these kinds of terms do not exist, he looks next synonyms. Third option is to look for terms that mean almost the same. Seizing upon terms is near concepts analogy and significant which are important factors when users want to remember things or learn something. [SIN02]

Products, which are easy to use, save costs that result from studying and using ineffective products. Easy learning saves users from frustrations and stress. If some web page is difficult to use, it drives away the users and the customers and gives a bad image of the corporation. Unfortunately there are numerous objects that are very difficult to use. Some may ask why people still use these kinds of products. Answer is that people adapt to difficult conditions without complaining. Other possibility is that product possesses enough utility to compensate for poor usability. One example of this kind of product is early WAP banking services. Although they contained several usability flaws, for example slow response time, poor input and output capabilities, inability to maintain connections reliably and navigational problems with deep structures; users could use basic banking services with them. [HIL02], [SIN02]

6 ELECTRONIC BANKING

6.1 Architecture

The existing back-end systems in the electronic banking are usually very old, because the same systems have been used for tens of years. This feature causes many restrictions and limitations to the used architecture. From Figure 14 can be seen TietoEnator's Finance Portal architecture, which has been developed in co-operation with Nordea.

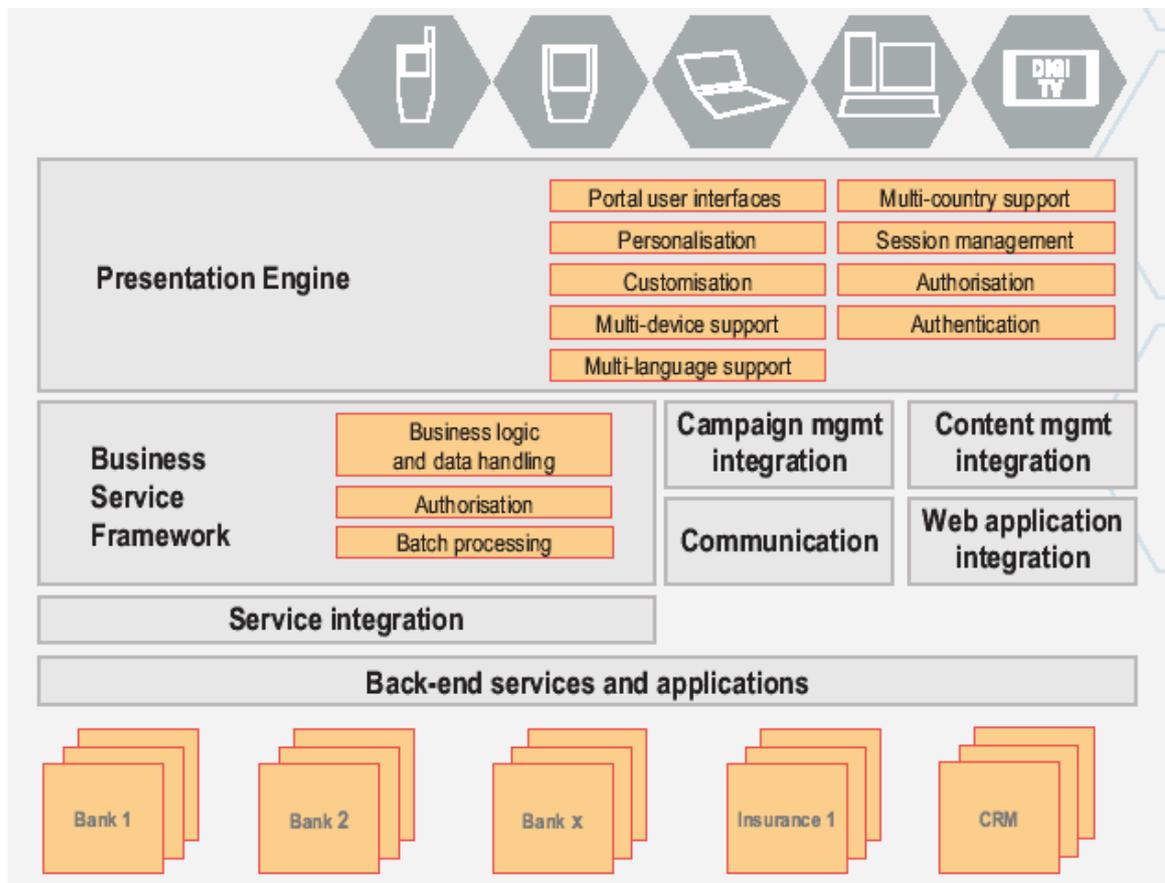


Figure 14. Architecture of Finance Portal [FIN03]

This architecture is scalable and it uses layered components that utilize Java and J2EE. Finance Portal is designed for building secure portals. It consists of the following main elements:

- *Presentation Engine*, which is responsible for the portal functionality.

- *Business Service Framework*, which is responsible for the functionality related to the self-service business processes, for example the business use cases.
- *Service integration layer*, which supports the integration of the services of several financial institutions into the same portal. [FIN03]

Additionally architecture contains a layer for back-end services and applications. This layer makes possible that this can be a common and cross-border platform for whole Nordea, which consists at the moment banks from 8 different countries, by hiding the differences in the back-end systems. When old legacy systems are used also in new portal, it brings cost savings, because they do not need to be re-done. Also the use of legacy systems means that all existent services have to work in the same kind. This enables that when new access methods are added to service, they also use the same logic and this way use cases are basically the same regardless of used device. Common platform also enables faster product development and new products, because new service has to be done only once to Business Service Framework and not separately to every legacy system. [KAN03], [PEK03]

6.2 Portal

6.2.1 In the past

Mobile portals and user expectations were investigated in year 2000 in Oulu, Finland. The study showed that the mobile user interface was not kept important and people prefer to use portals services by PC browser rather than by mobile device. About 80 percentages of users would choose PC browser for using portal. Main reasons for this behaviour were that it was so expensive; people did not trust that services would be secure enough and it was too complicated. It can be clearly seen that users have not adopted usage of mobile Internet. [KOI01] It is quite strange, although users thought that using portal services was complicated to use, they did not think that the mobile user interface was not kept important. Maybe better user interface would bring better user experience, because it is discovered that too often the customers find exciting products too difficult to use and not being useful enough for them. [HIL02]

Research that was done in year 2001 describes that all the mobile portals look the same; they do not differ from each other's. It can be seen that they lack personality and they offer same services for all customers. So, there is neither customising nor personalising. [MÄN01]

It is good to notice that these studies are about 2-3 years old and during these years many things have improved a lot. Mobile devices have improved explosively; the software, the user interface and the browsers have improved clearly and now almost every device has a colour display. Previously every device had a small, black and white display with basic user interface. Also connections are also much faster than 2-3 years ago, because nowadays almost every phone has fast GPRS- or/and HSCSD-connection. Additionally some mobile phones include EDGE that makes even faster data transfer rate possible. These features improve the user experience, although services have not improved so much during 2-3 years. It can be seen that browsers in mobile terminals are getting nearer to PC browsers and this will improve also the user experience.

6.2.2 Common view nowadays

Finance sector is in the middle of transformation and players do not have unified view of the whole financial environment. A personalised financial portal can give the opportunity to provide customised windows to suppliers, staff, customers and partners. With a good enough portal a service provider can deliver information anytime, anywhere and on any device, accurately, effectively and profitably. Customers are allowed to see the total picture of their current financial situation in a one glance. Technologies have reached a good enough level of maturity to enable the shift from technology-driven service development to user-experience development. [FIN03], [HIL02]

Portal should have a multi-bank support because, this way for example finance institution, which has different banks all over the world can integrate all of them to use the same back-end systems and the same portal. [FIN03]

Portal should have access to the bank's content management system, which allows the bank to monitor the recurring subject matter that they normally generate. Content is retrieved from the content management system based on personalisation and customisation parameters, and the user's profile. The content management system can contain content for all supported device types and languages. [FIN03]

Expanding of the portal is also important so that third party e-commerce services, for example electronic invoiced and electronic salary statements can be integrated into the portal. Additional information about rates and news from other sources could also be included. [FIN03]

6.2.3 Nordea's view

Currently the staff is piloting Nordea's new version of netbank (NG) and it will be launched someday in the near future. In this solution interaction with customer is very important. This can be achieved by aiming content to customers. This way also customers will be more pleased to services. In the current version of the netbank (Classic) amount of information is a problem, like in normal portal, because all information is not relevant to all customers. This can cause an information enterodynia that is usually one reason to dissatisfaction. [NUM03]

To be able to offer aimed content to customers, bank must have a good enough CRM (Customer Relationship Management) –system. This kind of system then helps Nordea to create the right kind of customer profiles. Customer satisfaction is very important and to improve this, customers are able to inform Nordea about so called "life events". These events are for example planning a house loan or a new child. When customer informs about some life event, Nordea can provide useful information about the event or even advise customer to contact some 3rd party. [NUM03]

Also one reason for creation of efficient customer profiles is that this way customer can be contacted through NG. In the old times when most of the customers took care of their banking affairs in the bank offices, they could easily be informed about things that would be important to them. Nowadays situation is totally different because most of the customers take care of their banking affairs through the Internet and this makes it difficult to contact the customers. With good enough customer profiles and personalisation interaction from bank to the customer will become much effective and fruitful. [NUM03]

Nowadays network reliability and bandwidth have improved clearly when compared to early days of mobile Internet. You can go almost anywhere and still you can use CSD- or GPRS-connection with your mobile. There are only few places in Finland that are not covered by the mobile Internet. Finnish operators have also roaming agreements with foreign operators so many places of the world are also covered. End-users have an access to the Internet regardless of time or place so service must be available really 24 hours a day, 7 days a week. Because of that portal should be able to be accessed with various terminal devices whenever the end-user wants and this must be done in secure way. [FIN03], [RAD03], [SON03]

In portal there are of course other players than Nordea. These players are usually some kind of content providers, which provide raw content that is aggregated to different services in the portal, for example investment information. Generally it can be stated that any kind of co-operation is possible as long as Nordea controls security, authentication and customer data. Co-operation with some operator to develop financial services, which are mentioned in the chapter 3.2, can be seen impossible if operators want to do user authentication. However one should not think that any kind of co-operation with operators is impossible. At the moment there are at least two co-operations, one is where operator provides Over The Air (OTA) –settings to customer's mobile phones. With these settings customers can access Nordea's mobile services. Other co-operation is a service where customers can inquire their balances through SMS. It is good to remember that operators provide access to every service.

One threshold for using mobile services has been the difficulty of settings. Although Nordea provides OTA-settings that can be found at Classic and at NG, customers have had to order them through Internet. Problems with settings are going to decrease because of the new TCP/IP enabled mobile phones. These phones only need operators' settings and with these settings customer can also access mobile services, if operators' gateway supports SSL-tunnelling like shown in Figure 15.

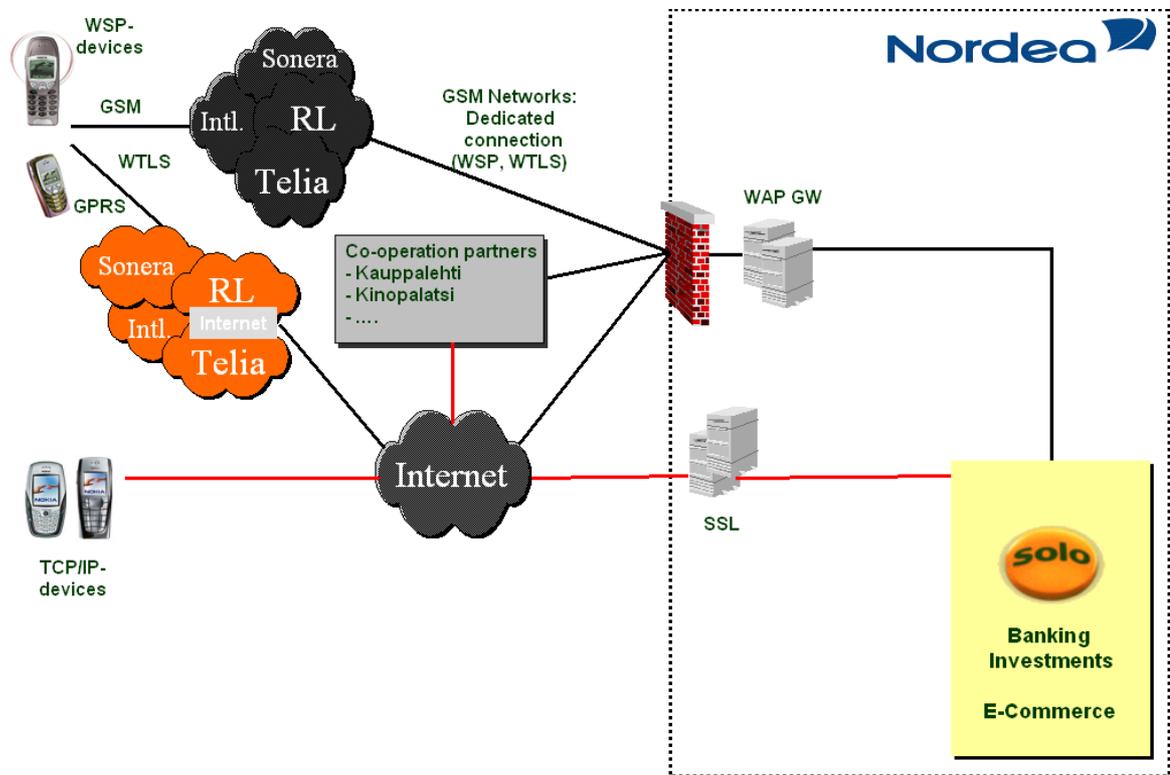


Figure 15. New access method

Context of use is very important in the banking services because there are many customers and these customers have different kind of interests about service. With the help of personalising, customising and similar services in every media, customers can choose their preferred way of using services and modify them to be convenient for them. Due to this it is important to support many different devices. One goal is that customers have connection

to the bank if they just have codes to Nordea's service and some kind of gadget, which has Internet connection. This surely helps service to take off like said in chapter 3.5.

Although it was stated in the chapter 3.1.2 that vertical portal where people are like-minded the customer loyalty is high, Nordea does not think this way. "This theory can be relevant when there is only one portal for the like-minded people. When there are many portals, which offer same kind of services in principle it is more or less the opposite; the competition is just a click away from Nordea's portal. To be sure that customer stays in Nordea's portal; Nordea has to constantly develop its services, especially customisation, personalisation and usability." If these three parts are done well enough, customer loyalty will be high, because customers are offered those kinds of services that they really need and services are easy and secure to use. [KAN03]

It is good to keep in mind that banking is not something that customers do for fun. Like stated in chapter 5.1 users goal is not to use banking services but to for example to pay a bill. Because of this, the service must be secure and as convenient as possible to use. One thing that have been noticed is that customers do not know what kind of services are available in portal, so it is also important to be able to inform the customers about services that would be useful to them. These things must be done appropriate and informatively, not with "bells and whistles". [NUM03]

6.3 Terminal adaptation

When performing terminal adaptation, the main idea is to offer the same content and services to different devices and take device's restrictions, features and possibilities into account.

At the moment Nordea Finland has implemented some kind of a basic terminal adaptation. It offers 3 different services. These services are Classic, text version of Classic and SoloWAP for mobile terminals with WAP-browser.

There are some problems that affect the customers and the bank in this kind of terminal adaptation. Main problem for the customers is that they have to know about these three different kinds of services to be able to use them. Although these services are advertised, some customers do not know about these, and additionally usage of SoloWAP requires own settings to mobile terminal. Because of these things many customers are confused about services that they could use, and this way Nordea do not have so satisfied customers or even lose some potential customers.

Classic and text version of it go hand in hand, meaning that they consist of the same functions and SoloWAP consists of the most important functions. These use same back-end services but when developing a new function to Nordea Finland's services it only affects Nordea Finland's service. If this new function would like to be implemented to every other country, it would have to implement separately and would be very expensive and slow. So, this basic terminal adaptation works fairly only in Finland but it would be wise to be able to implement only once new function that works right away in every country.

Three different services are shown in the next figures.

The screenshot displays the 'Personal services' page of the Nordea website. The interface includes a top navigation bar with the 'solo' logo and 'Nordea' branding. Below the navigation bar, there are links for 'Home page', 'Mail', and 'News'. A secondary navigation bar contains 'Exit', 'Settings', 'Help', 'Terms', and 'Calculator'. The main content area is divided into several sections:

- Useful information:** Contains a link for 'Changes in the password table'.
- Payment status:** Contains links for '2 payment(s) falling due' and 'Direct debit and direct payment authorisations'.
- Current and currency accounts:** A table listing account details.

Name of account	Balance	Funds available	Balance date
295018-20590 euro	892,55-	9.107,45+	12.12.2003
295020-20571 euro	7.552,22+	7.552,22+	12.12.2003
295062-29504 SEK	1.675,00+	1.675,00+	12.12.2003
- Investment accounts:** A table listing investment account details.

Name of account	Balance	Interest%	Due date
295024-29505 euro	6.500,00+	0,00	12.12.2003
- Loans:** A table listing loan details.

Name of account	Balance	Following payment	Maturity
-----------------	---------	-------------------	----------

The left sidebar contains a menu with categories: Payments (New, Transfer, Abroad, Falling due), Accounts, Cards, Loans, Investments, Insurance, Order travel currency, Gift voucher, Service fees, and Other service providers.

Figure 16. Classic for full-size browsers

Solo Personal services Nordea

[Home page](#) [Menu](#) [Exit](#)

Useful information

[Changes in the password table](#)

Payment status

[9 payment\(s\) falling due](#)
[Direct debit and direct payment authorisations](#)

Current and currency accounts

Name of account		Balance	Funds available	Balance date
295018-20590	euro	892,55-	9.107,45+	29.12.2003
295020-20571	euro	7.552,22+	7.552,22+	29.12.2003
295062-29504	SEK	1.675,00+	1.675,00+	29.12.2003

Investment accounts

Name of account		Balance	Interest%	Due date
295024-29505	euro	6.500,00+	0,00	29.12.2003

Loans

Name of account		Balance	Following payment	Maturity
295015-20571	EUR	41.761,73-	358,41+	21.01.2004

Shortcuts

[Payments](#) [New Transfer](#) [Falling due](#)
[Accounts](#) [Cards](#) [MasterCard](#) [Visa](#)
[Investments](#) [Insurance](#) [Mail](#)

[^Back to top](#)

Figure 17. Text version of Classic.

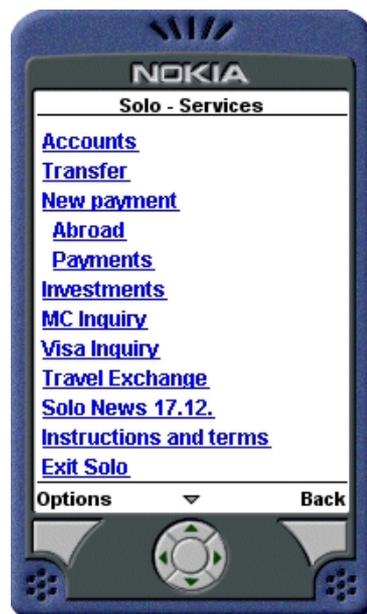


Figure 18. SoloWAP, Nordea Finland's WAP service

The bank and the users benefit from terminal adaptation if it is done well enough. Users benefit from it because, applications that they use look as identical as it is possible and they are able to use service with a large number of terminals. The bank benefits from this by getting new users easier than before because new inventions especially user interfaces face some resistance. When interfaces look the same as much as possible, users tend to start using different channels easier. [HIL02]

Terminal adaptation is becoming more important now and in the future because users have different kinds of terminals, which they would like to use. It could be very normal that user has 3 different terminals. These are a PC browser at work and home, one mobile terminal which is used in doing business when he is not in his office and another mobile terminal for private usage that is used when he is not at home. Services should work intuitively similarly regardless of the used terminal.

6.4 Usability

When interacting with a banking service, it is important for the user to know what should be done to reach the preferred goal and whether or not this has been done the right way. These are gaps here that were introduced in chapter 5.2. Usually in banking services these things have been solved, because the services have existed such a long time. This should apply mobile services too, because a product should be usable also with a variety of browsers. This is possible by using the same terms and analogy. [HIL02]

Good usability, especially in banking services, is very important because these services are widely used and they are almost vital to users. When users use banking services, all they want is to get the things done securely, easily and correctly. This situation is different in some other portals, where users go for the fun. There can be all kinds of “bells and whistles” but in a banking portal, these things should not be used. Reason for this is that a banking portal is just a medium that helps the user to achieve his goal. [NUM03]

Requirement for usability is the continuous availability of the application, which is very important, because banking through Internet or mobile Internet should not depend on time. Banking services should be available everywhere at all times. When you add here any possible device, you get a banking service, which can be really used 24 hours a day, 7 days a week.

When the bank compares all these previously mentioned things it is certain that customers will be satisfied and it brings more users to service.

7 DESIGN AND IMPLEMENTATION OF THE NEW BANKING CONCEPT

Planning of the mobile terminal adaptation in portal started when new version of WAP gateway was evaluated between November 2002 and February 2003. The main idea of this project was that if Nordea developed a new version of mobile banking services, what would be the used technology and would gateway be able to convert this used technology to legacy WAP-terminals. We learned that most suitable language for future WAP 2.0 compliant and other mobile terminals would be eXtensible HyperText MarkupLanguage (XHTML) basic and Wireless profile Cascading Style Sheets (WCSS). New version of mobile banking services should be done in a way that content and layout would be defined by XHTML and WCSS. There were of course some problems, like XHTML to WML conversion. Supporting legacy WAP terminals require usage of WML, so this is seen quite important at the time, because there are many legacy WAP-devices in the markets. [JAN03]

When performing terminal adaptation, the main principle is to separate content from presentation. The presentation is done by different style sheets which are called in Internet world Cascading Style Sheets (CSS) and in mobile Internet world (WCSS). Using of CSSs in Internet world is very ordinary, but in mobile Internet WCCSs is quite new. They were introduced the same time when WAP 2.0 specification was released in the year 2002. [JAN03], [WAP02], [WCSS1] In previous project we thought that this could be as simple as described above. Unfortunately it is not so, because with style sheets you can do just little changes to applications. You cannot do massive adaptation, for example entirely different application for the PC browsers than a small screen size browsers containing same content. Style sheets make it possible just to do little adaptation, like different fonts, padding and margin and so on.

It can be seen clearly that mobile terminals have improved a lot since the beginning of year 2003. Most of the new devices have quite good XHTML browser and their style sheet support is getting better and nearer to PC browsers. [MIC03], [NOK03], [SIE03], [SER03] This means that usage of mobile Internet will be improved if there are services that are

good enough. For Nordea this means new potential customers who would like to use good looking mobile services, which have high usability. This can be achieved by new mobile banking service that uses terminal adaptation.

In this chapter we try to find a way in doing that and in this way Nordea would be able to support mobile terminals in the best possible way. This should be done with help of terminal adaptation, which causes win-win –situation for the bank and for the customer that has been stated earlier. At the same time one should not forget support for the legacy WAP terminals, which are still widely used.

7.1 Terminal adaptation

At the beginning of mobile Internet, users had almost the same kind of mobile terminals because all the terminals had small, black and white display. Nowadays the situation has changed significantly: terminals have usually colour display, versatile browser and different display size that vary from approximately 101x80 pixels to 640x320 pixels. For example Nokia and SonyEricsson together have 7 different display sizes that can be seen from Table 1.

Table 1. There are many different display sizes. [NOK03], [SER03]

Nokia			
			
Nokia 6820	Nokia 6600	Nokia 9210(i)	Nokia 7700
128x128	176x208	About 490x165	Varies from 480x217 to 640x320
SonyEricsson			
			
SonyEricsson T310	SonyEricsson T610	SonyEricsson P800	
101x80	128x160	208x320	

When you add here other manufactures' mobile terminals, PDAs, tablet PCs and even digi-
TVs, one should understand that terminal adaptation is very challenging.

From Table 1 you can see three different screen sizes that were used in an earlier project.

Welcome to Solo

Customer number:

Code:

© Copyright Nordea



Welcome to Solo

Customer number:

Code:

© Copyright Nordea

Figure 19. Different screen sizes used in earlier project.

The idea in this was that every device would be categorized, for example Series 40 (upper left), Series 60 (upper right) and Series 80 (bottom) in Nokia's situation. Because SonyEricsson's devices are not the same as Nokia's, as it can be seen in Table 1, they would need their own categories. When you add to this list every manufacturer's devices, you can easily get quite a number of categories.

This kind of solution where almost every device gets its own category is not a good idea, because that would mean a lot of work for Nordea. Better solution would be that Nordea defines some categories, for example full size, medium size, and small size. Full size meaning PC browsers, medium size would mean devices like SonyEricsson P800 shown in Table 1 and small size meaning for example Nokia 6820 shown also in the same table. Of

course, now comes the question of what category would Nokia 9210(i) and Nokia 7700 belong to? The solution for this would be to define another category like “medium-wide”. This brings up another question: what would be the right number of categories to begin with? Problem for this is that mobile terminals do not only have different display size, but also different features, which makes terminal adaptation difficult. It needs further investigation to solve this problem.

7.2 User interface structure

When designing the user interface structure for the mobile application, the most important thing is to make sure that all changes will be done to the presentation engine shown in Figure 14. By doing this the same business logic and data handling can be used in every application. This will make developing of new applications and support for new channels easy, inexpensive, fast and possible. [KAN03]

7.2.1 NG for PC browsers

NG for PC browser consists of 4 different areas. These areas are A, B, C and D. All these areas can be seen from Figure 20. A-area consists of the brand area (logos and Netbank text), top bar (Daily banking, Saving and Investments, Loans and Financing, Insurance and Information and Advice -links) and toolbar (Logout, Help, Settings, Euro calculator -links and mail-icon). B-area consists of the left menu where can be seen links to New payment, Payments, Cards, Total overview and Edit shortcuts. Usually this area consists of complete menu, which cannot be seen here. C-area, which can also be called as work area, is the area where is text Welcome and Attention, Last five transactions and News and articles –boxes. D-area is an area on right where are Preferred customer, Solo Market and Other service providers –boxes. In some situations C and D area can be combined to one area. This happens for example in New payment.

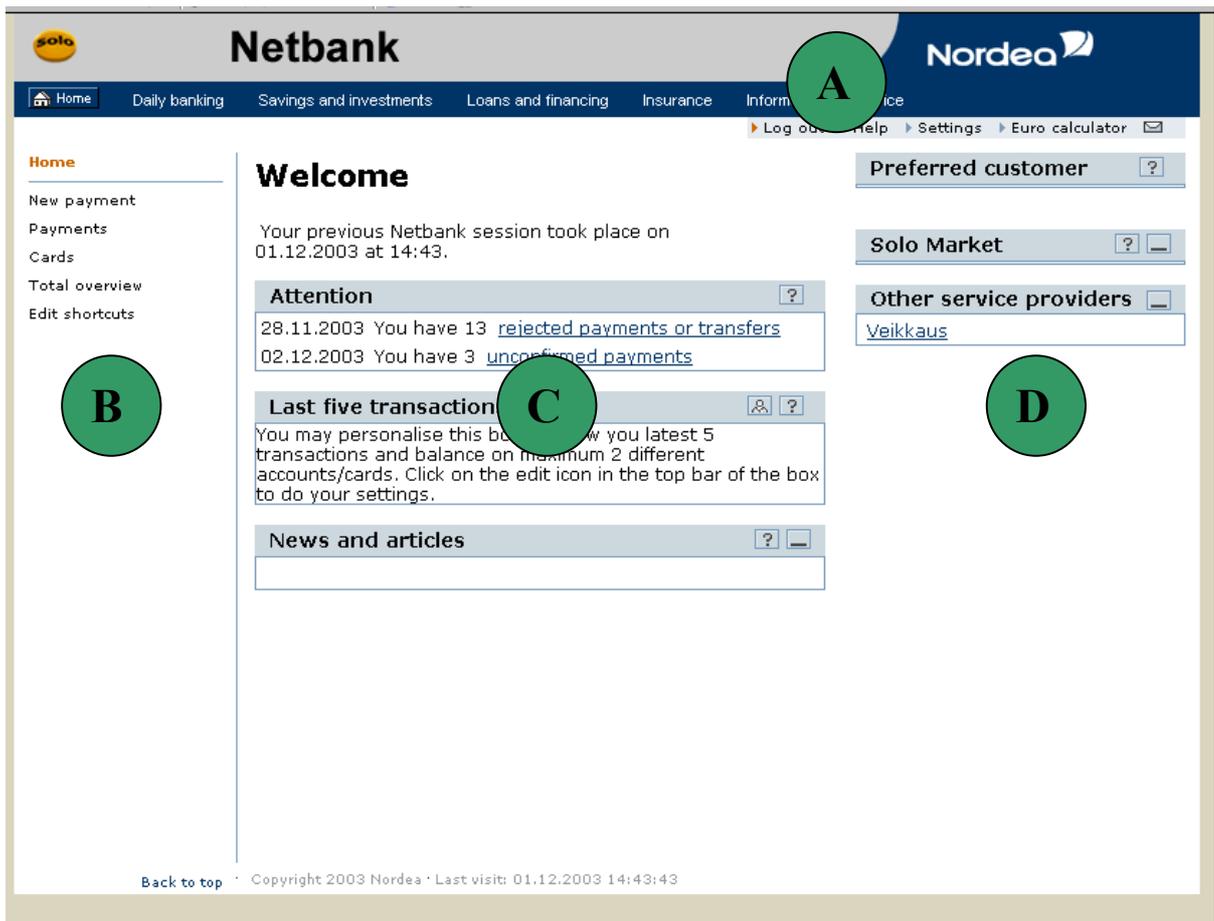


Figure 20. Different areas of NG [SOLO1]

All of these areas are build in the Business Service Framework shown in Figure 14 and because of that these should be used as they are. Some areas can consist of sub areas, for example A-area include brand area, top bar and toolbar, which can be used separately.

7.2.2 Option 1

An option for start page is shown in Figure 21.

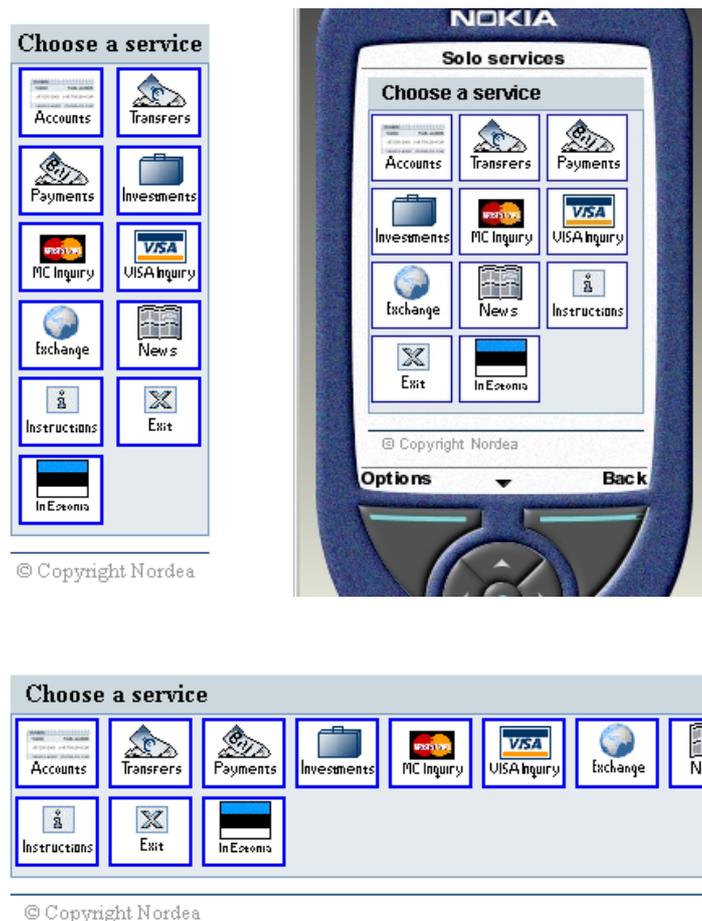


Figure 21. First option for the start page. [JAN03]

This is a combination of Nordea's current version of SoloWAP, investment application called Euroquote and current solution in user interfaces in the most of the mobile terminals. This was introduced in an earlier project. The idea in this was that the menu in the first page after successful login would be shown as pictures. One reason for this was that currently many mobile terminals include same kind of user interface. [MIC03], [NOK03], [SIE03], [SER03] Because user have adopted this kind of user interface in their mobile terminals, they would adopt it also in the banking application. Although this might look good, it has at least few flaws.

Users could get confused when they are using mobile terminal services and when they are using Nordea's service and lots of pictures in an application are not wise because it slows down clearly the connection. The other problem is that it would be very difficult to

describe all services, for example Daily banking by one picture. It is much easier to describe it by a simple link. However some pictures could be used to describe clear functions. One example for this kind of picture would be picture of a house, which would lead to service's front page. Pictures also make application look aesthetically better. [KAI03]

Additionally the user interface layout is not the same kind that in the NG, which is illustrated in Figure 20. It would require many big changes to current architecture. Because of these reasons, this kind of approach is not wise to develop.

7.2.3 Option 2

Second option for start page is shown in Figure 22.

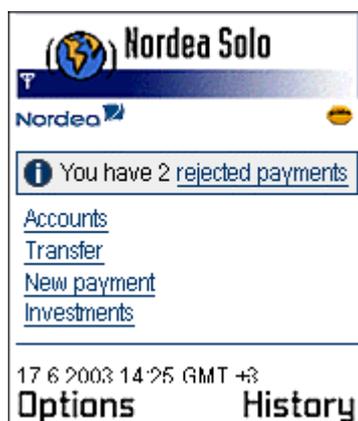


Figure 22. Second option for the start page

This option was thought at the beginning of this thesis. It first seemed like a good idea, because for example it uses same terms than NG, but after awhile we figured out that this kind of approach would need big changes to the presentation engine and also maybe to other places. Reason for these changes was that this option does not include all areas that are used in NG. This solution uses only some part of A-area and B-area by mixing them. If this solution would be used it would require changes to current architecture.

After this we noticed that structure should be like in Figure 20. By doing this all the areas and the sub-areas could be re-used and in this way gain benefits when developing application. It would be also usable, because the same terms and analogy are being used than in NG.

7.2.4 Option 3

Two previous options had features that make them technically too complex to implement, so better solution had to be found. Best solution for technical point of view was that areas described in chapter 7.2.1 could be re-used. These areas can be seen from Figure 23 and next to it described how these areas could be used in the mobile version.

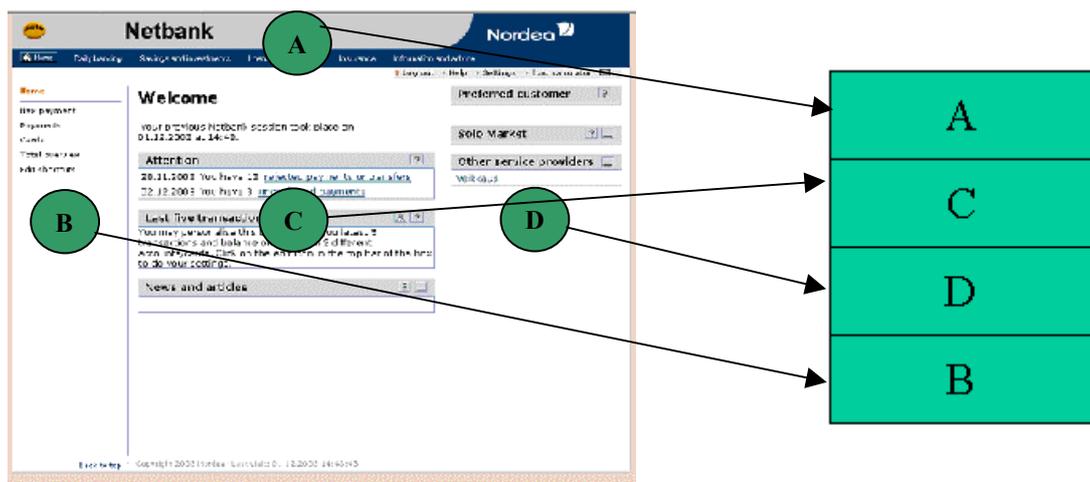


Figure 23. NG's areas to mobile version

In this solution it is good to notice that D-area, which usually includes information and links to 3rd party services could be easily leave out from mobile version. A reason for this is that users do not possibly prefer much information in the mobile channel. This decision is left for the future.

7.3 Example use case

A good example of one use case is making of New payment. Approximately 50 percent of sessions include making of New payment. So, this is one of the most used functions in Classic and in SoloWAP. [W3REP] New payment also consists of useful procedures, which makes it a good example. When a user makes a New payment he first enters needed information, then accepts it, and if every information is right, application shows details of payment and after that the user can confirm, change or delete his payment. If he chooses to confirm, he gives certain confirmation code and after this application shows information of confirmed payment. [UCNOR] It is good to remember that this description of New payment is not as detailed as it is in real use case. Described flow is shown in next figures.

The screenshot displays the 'New payment' interface on the Netbank website. The page is titled 'New payment' and shows a progress bar with three stages: 'Input 1', 'Confirm', and 'Receipt'. The 'Input 1' stage is currently active. The main content area is divided into two sections: 'Payment information' and 'Optional payment details'. The 'Payment information' section includes fields for 'From account' (101435-), 'Beneficiary database' (Choose beneficiary...), 'To account' (230520-), 'Beneficiary's name' (Teppo Jansson), 'Amount' (10), 'Due date' (09.12.2003), 'Reference number', and 'Message' (for Thesis.). The 'Optional payment details' section includes a 'Receipt' dropdown (No receipt), 'Recurrence' (Once), 'Number of payments' (checkboxes for 'or' and 'Continuously'), and a 'Save payment' checkbox. The page also features a navigation menu on the left and a footer with copyright information.

Figure 24. Making of New payment, step 1. [SOLO1]

Netbank Nordea

Home | Daily banking | Savings and investments | Loans and financing | Insurance | Information and advice

Log out | Help | Settings | Euro calculator

Daily banking

- Payments
 - New payment
 - New transfer
 - Cross-border payment
 - Beneficiary database
 - Unconfirmed payments**
 - Due payments and transfers
 - Saved payments
 - Direct debit and direct payment agreements
- My shortcuts
 - New payment
 - Transactions and information
 - Payments
 - Cards
 - Total overview
 - Add this page
 - Edit shortcuts

New payment

Input 1 **Confirm** Receipt

Unconfirmed payments: 1

Unconfirmed domestic payments

Due date	From account	Beneficiary	Type	Amount	Edit	Delete
09.12.2003	101435-	Teppo Jansson	Domestic payment	10,00		

Status : To be confirmed
 To account : 230520-
 Beneficiary : Teppo Jansson
 Reference number :
 Recurrence : Once
 Number of payments :
 Receipt : No receipt
 Save payment : No
 Message : for Thesis.

Sum: 10,00 1 payments

[Add another payment](#)

Confirm by entering the four digit code from your code card and press the Confirm button..

Confirmation code H :

[Confirm](#)

[Cancel](#)

Back to top | Copyright 2003 Nordea | Last visit: 09.12.2003 10:46:16

Figure 25. Making of New payment, step 2. [SOLO1]

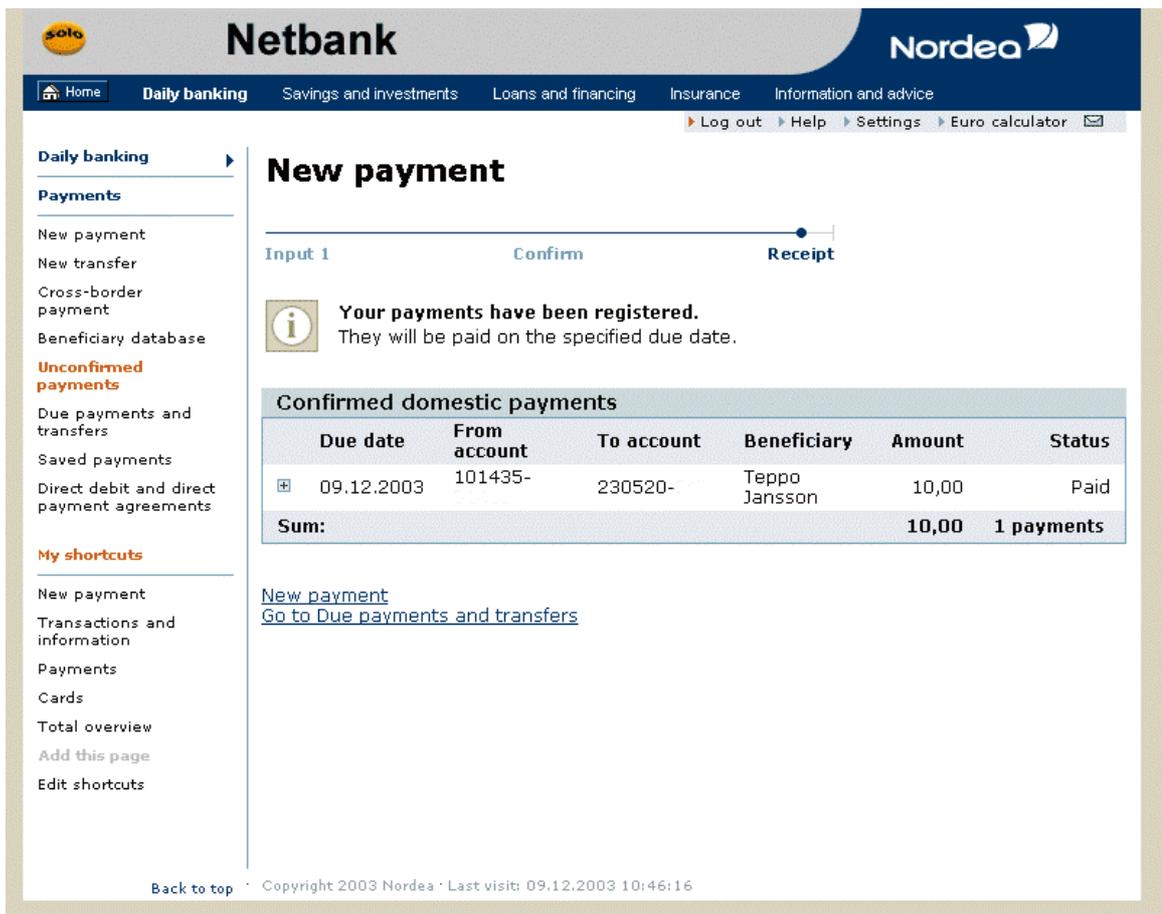


Figure 26. Making of New payment, step 3. [SOLO1]

This service flow and connections to other layers that are shown in Figure 14 should be the same regardless of used terminal. By doing this only a layer that needs to be changed is the presentation layer. This layer could be different depending on used terminal, for example in mobile version of New payment Read barcode-function would be unnecessary. This thesis does not point out, which features should be removed for example from the mobile version, because that work belongs to Nordea's e-banking unit.

7.4 Implementation

Implementation was part of the Mobile Architecture Proof of Concept –project in Nordea. The goals of this project were to evaluate possibilities using same architecture than NG when supporting variety of mobile terminals and terminal adaptation.

In this Proof of Concept, only a few terminals from different categories were supported. Also application was limited and it consisted of only few functionalities. These terminals were chosen in a way that they would give enough information is it possible only to make changes to presentation layer when developing multi-channel netbank. Functionalities were chosen in a way, that those would contain important features. In addition it was kept in mind that the mobile version of NG should be able to support for example web content management and publishing tool, which publishes news and help sections to the portal.

7.4.1 Menu and user interface layout

Next figure shows an example how would start page look like in mobile version when a new category, which was mentioned previously, was implemented. This category would be suitable for all devices that are under “small-category”, for example Nokia series 60 – terminals.

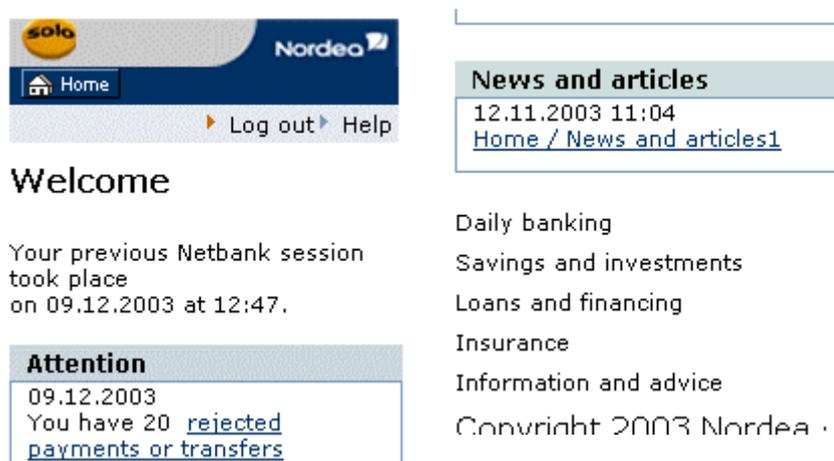


Figure 27. Example of the start page in the mobile version of NG.

In this example minimize, personalise and help buttons are left out from boxes. Reason for this is that these features have to re-think in the mobile version. This is because for example help button opens a new window in the NG for PC browsers and mobile terminals do not usually support multiple windows and if they do customer could easily get lost.

Although start page illustrated in previous figure looks quite fine, there is one big problem: the menu, which contains links to Daily banking, Savings and investments, and so on. Menu is a problem because if same menu that is used in full size version would be used also in mobile version all often used functions would be too far away. This is illustrated in Figure 28.

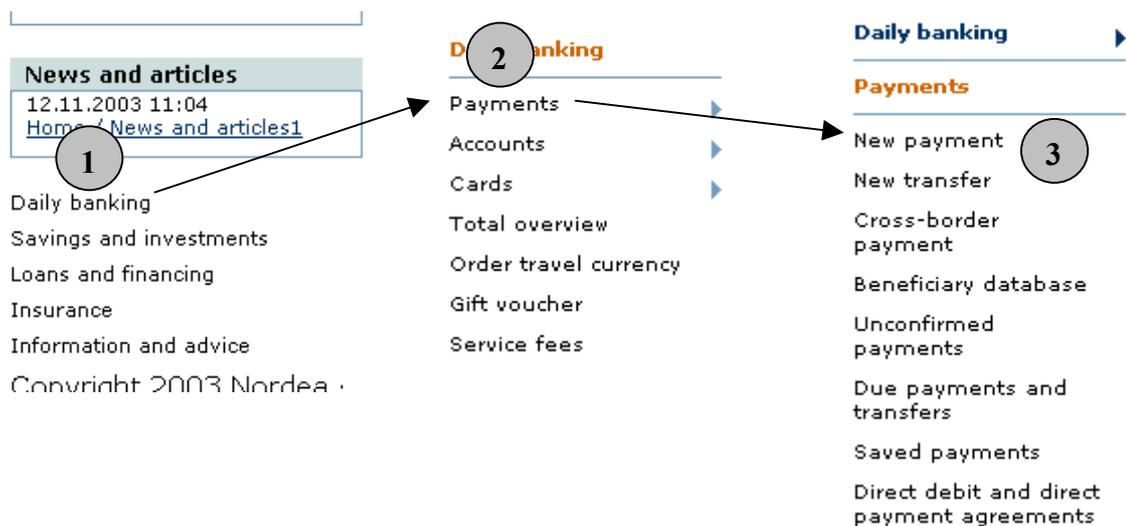


Figure 28. How to make New payment with the current left menu.

As you can see from previous figure, it requires three operations from the user to start making a New payment. This is certainly too much, because New payment is one of the most used function and it should be accessible easily.

Because the menu will not become at least smaller when time goes by, some solution for this should be figured out. One possibility would be that user can personalise one menu for the mobile version of NG same way that is possible now in full size version. This way user could personalise two menus; one for the PC browser and one for the mobile version.

It is good to remember that personalisation can cause also problems, because some important functions and opportunities can be “personalised-out” if customer personalises the application too much. To avoid this it would be wise that user has always opportunity

to view the whole menu. This is taken care of in text version of Classic like shown in Figure 29.

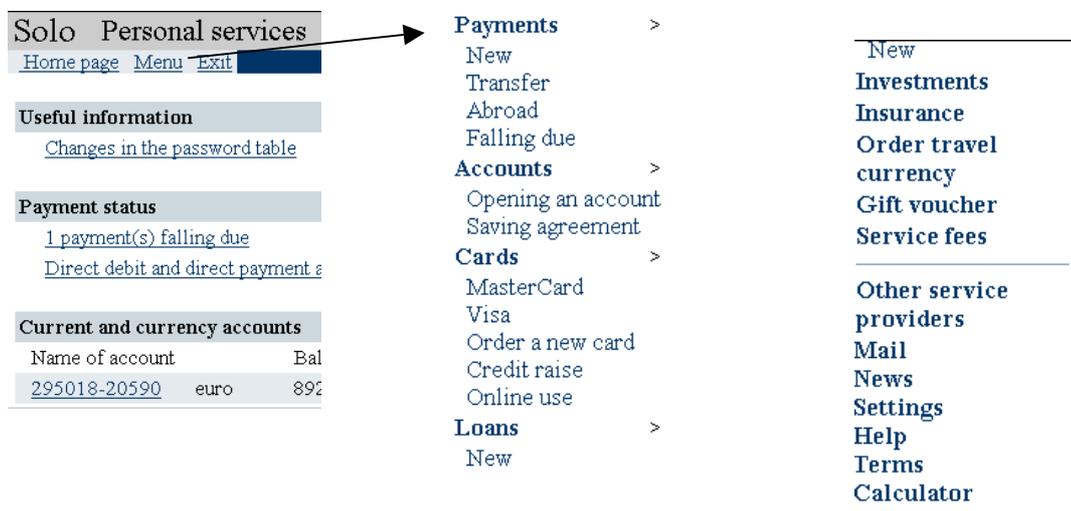


Figure 29. Possibility to view every function in text version of current Netbank.

Other possibility, which is used quite widely nowadays in the Internet, is a sitemap where user can see all the possible functions that he can do. Example of this is shown Figure 30.

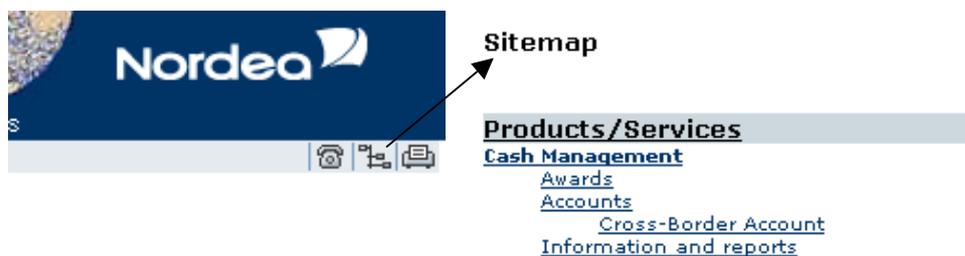


Figure 30. Example of a site map. [NORDEA]

When previously mentioned things are taken under consideration, mobile version's structure could look like shown in Figure 31.

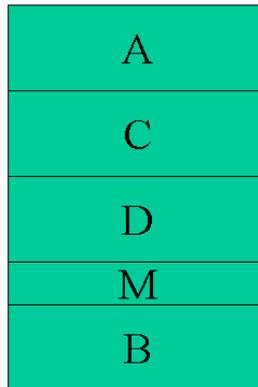


Figure 31. Possible structure for mobile version of Netbank

This solution would consist next areas:

- *A-area*: would be almost like normal A-area, consists logos, Home-link and modified toolbar, where is logout and possibly help –options.
- *C-area*: A normal work area with modifications in mobile version.
- *D-area*: A normal information area with modifications in mobile version.
- *M-area*: A totally new area, which would contain user’s personalised menu. If user has not done any personalisation, this menu will not appear.
- *B-area*: A menu consisting most used functions, but possibility also to view every function.

A-area would consist logos, Home-link and at least logout. This area would be always at the top, so users could easily either go to the Home-page or to exit NG.

C-area would be work area, like in full size version. Work area consist modifications in mobile version. At the start page after login there could be a welcome text and in other situations normal work area, for example New payment. When New payment is done, there is no D-area just like in the full size version shown in Figure 24.

D-area, which includes important information and some advertisements, would be assigned between C-area and M-area or B-area. Reason for this is that like stated in chapter 6.2.3 most of the users use banking services through the Internet, so there must be a good enough way to contact the customer also in the mobile version. It is very important to

remember that in the mobile version D-area should not be used much, because that will make the usage of service more difficult if there are too much irrelevant information. One example could be that only a heading of important information is shown and if user is interested of this information he could read more of it when choosing the link. By doing this there would not be too much content and B-area, where the most used functions are, could be easily accessed. It is good to remember that user's goal is to get needed banking services done, not the using the service like stated in chapters 5.1 and 6.2.3.

Reason for creating totally new area, M-area, is that mobile users need a menu that they can personalise and this way get fast access to the functions they want. By doing this for example access to New payment could be done easily and not difficulty like shown in Figure 29. If user has not made personalised M-area, this area would not be shown. In this kind of situation most used functions would be accessed easily through B-area's menu. Nordea would have to define these most used functions like it have done in the text version of Classic shown in Figure 17.

Additionally menu in B-area, which is used in NG, is too complex and technically difficult to be used also in mobile version. Because of this, new menu is needed to implement for mobile version. This menu should be usable in all mobile devices, regardless of the screen size.

7.4.2 Categories

During implementation we found out that creating of different categories is quite difficult and time consuming. Reason for this is that these new categories are basically just modifications of full size version, which is used by PC browser. This means that when full size or some other category changes, the same change must be done to all the other categories as well. Abstract structure of operation of different categories is shown in Figure 32.

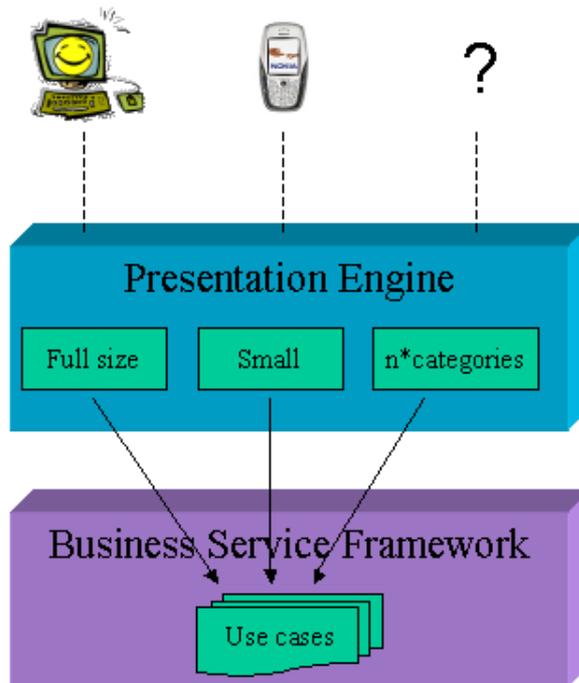


Figure 32. Abstract structure of operation of different categories

When some browser accesses to service, its user-agent is checked and it is directed to right place, for example to full size service. When browser, who is defined “small”, accesses to service, it is directed to small size service. Currently the identification is based on whole user-agent string so, for example “*Nokia6600/1.0 (3.42.1) SymbianOS/7.0s Se*” or “*Nokia6600/1.0 (3.44.1) SymbianOS/7.0s Se*”. These are the user-agents from Nokia 6600 mobile phone; the only difference between them is the mobile phones software version (3.42.1) and (3.44.1). When the detection is based on whole user-agent string, developers have to update their user-agent databases constantly and browsers can easily end up to wrong category. Example of this could be if there would be three different categories: Full size, Small size and Other size. Small size is meant for Nokia 6600 mobile phones and Other –category is meant for common mobile phones. In this category there are just few services and the full size and the small size contain all of the services. Small size –category contains user-agent “*Nokia6600/1.0 (3.42.1) SymbianOS/7.0s Se*” and when Nokia 6600 with different software version comes to markets, for example “*Nokia6600/1.0 (3.44.1) SymbianOS/7.0s Se*” it is directed to Other –category because the user-agents are not exactly the same. In mobile world, updated software versions are released often and because of this it is impossible to keep user-agent database fully updated. Better solution

for detecting user-agents would be that only some part of it would be recognised, for example in previously mentioned case “*Nokia6600/1.0*” would be enough and it would not matter if different software versions would be released. It is also important that user-agent database can be updated while on-line, because services need to be accessed all the time.

When supporting a number of categories, it is important that the user has an opportunity to choose his preferred service. An example of this could be a user that has PC browser and is connected to Internet by modem. He would like to make quick transaction and he wants to use the small size service. His browser would be identified to full size, but he must have an opportunity to choose the small size version. This could be done in a way that first user is directed to full size version’s login page and there is a link to small size version. This way user is not forced to use the version he might not want to. Another example could be a situation where user has a browser that has not categorised to any category. In this kind of situation user could see a disclaimer, which says that this browser is not fully supported yet, but he could choose either full size version or small size version of the NG.

Every category uses the same use cases, so when something changes in some use case, for example shown in chapter 7.3, every other category had to be also changed. Currently the NG Solo includes approximately 80 different use cases, so likely there will be changes quite often. If there are for example 4 different categories, even little change in some use case can cause really big workload when updating categories.

This kind of solution would not fully fulfil the requirements of real terminal adaptation, which goal is that both the bank and the customer would benefit from the solution. Customers benefit from this solution because the services would like same kind. For Nordea the solution would bring some cost savings, because application development and maintenance costs would be smaller than previously. Reason for this is that supporting, for example 4 different categories is better than have to support all browsers separately.

8 CONCLUSIONS AND FUTURE WORK

It can be clearly seen that the current solution for supporting a number of categories is not working well enough. Reason for this is that categories are just copies that have been modified and all of them contain the same references to use cases. This means that if some use case is changed, same change need to be done to every category. So, developing and maintaining different categories is not easy, inexpensive nor fast like it should be. To improve this feature, categories should not contain any use case specific data. This would lead to situation that if some use case is changed it would affect instantly to all categories. Exact solution for improvement is left for the future.

The number of categories to start with depends on decisions, what kind of browsers will be supported? At the moment there could be two categories; full size and small size. Full size would contain all the PC browsers and the small size would contain mobile terminals. The problem in this solution is that browsers with the same display size contain different features. Solution for supporting mobile terminals with the same display size but different features, for example support for WAP 1.x browsers, is left for the future.

When some new terminals want to be supported that cannot be categorized to any existing category, for example digi-tvs, new category must be implemented. If adding of new category is planned well enough, this should be able to be done easily.

What will be the decision which browsers are able to access the banking services? There are two different possibilities; one is that all browsers have access the banking services, the other one is that Nordea will give permission to browsers it wants to. Latter one makes it possible that services are customised for supported browsers in the best possible way, but at the same time this kind of solution will leave out a number of terminals. First solution would be better because it does not leave out any browsers. In this kind of solution it is good to remember that there should be a possibility to outline some browser out, for example because of a possible security risk. When the service is accessed with a browser that the service is not customised for, there could be a disclaimer at the beginning saying that with this browser the user experience would not be the best possible. This way the user

will know that there can be some differences in the user interface and the user experience will be more pleasant.

Browser identification should be improved if more than one category will be used, because current solution does not support well enough different categories. Browser identification should be based on a certain element of user-agent and not on the whole user-agent. By doing this, for example different software versions in the same mobile terminal would not complicate categorisation. Updating the browser-database should be able to be done online, so banking services could be used all the time regardless of possible changes in the browser-database.

It could be seen that current menu, which is used for PC browsers, does not work in NG's mobile version. So menu must be redone for mobile version. When designing a new solution for menu, it should be kept in mind that the same menu could be used in every mobile. Menu should only contain most used functions but there should be also possibility to view all the functions. This way menu would be small enough for mobile terminals. When supporting totally different terminals, for example digi-tvs, new menu must be implemented.

Current menu-solution in NG Solo for the PC browsers contains possibility to make personalised menu, this kind of possibility could be advisable to be used also in mobile version. In this way user could personalise functions, which he prefers. It is important to remember that user should not be able to personalise menu too much, meaning that after personalisation, he still must have an opportunity to view all functions and possible new features. Problem in personalising menu is that it would be done in NG for PC browsers and users may not discover this kind of possibility. This belongs to usability of personalisation and it is left for the future.

Web content management and publishing tool publishes help sections and news to full size version. When user views help sections, they are opened to a new window. This kind of behaviour cannot be possible in mobile terminals, because they do not usually support multiple windows. Either these cannot be opened to the same window, because this way

user would get confused and possibly lose his session in the NG. Another question is that, should news contain different information in mobile version, because news usually contains a link and when it is clicked, a lot of information is shown to the user. Solution for these is left for the future.

Altogether it can be stated that terminal adaptation in portal can be done but it requires lots of careful consideration and designing. When it is done well enough it brings advantages to Nordea and its customers.

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