SAINI – Electronic Healthcare Services Concept
Road Map for implementation in Finland

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SITRA

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FOREWORD

The SAINI report SAINI – Electronic Healthcare Services Concept, Road Map for implementation in Finland is the national Pplan for implementing on-line health care services health care services for citizens. It creates a framework for supporting the public in their independent promotion of their own health as well as flexible electronic transactions within the health care service system.

This English version is a shorter version of the final SAINI report in Finnish. It is part of the SAINI project (interactive electronic services for citizens) coordinated by Sitra and involving the Ministry of Social Affairs and Health, the Social Insurance Institution of Finland (Kela), the National Public Health Institute, the Association of Finnish Local and Regional Authorities, the Finnish Centre for Health Promotion (Tekry) and other operators, companies and financing institutions in health care and information and communications industries.

There is an obvious demand for electronic health care services. The government and local authorities as well as the private sector and NGOs are all developing electronic services of their own. Currently, there are a number of different pilot projects in progress. At the same time, significant IT acquisitions are planned and implemented and decisions upon system development and products and services to be provided are made within companies.

It's important to ensure that services are not developed from the organisations' perspective only. The availability of the services for citizens and customers need to be secured according to the one-stop-shop principle as much as possible.

The report describes the SAINI electronic health care services for citizens –concept, the guidelines for national architecture and the draft for the phased implementation process (road map). The SAINI report serves as a kind of handbook providing a view of implementing user-oriented, high-quality, cost-effective, compatible and functional electronic services without forgetting the need for renewing health care structures and processes.

The SAINI service concept is a combination of centralised and decentralised electronic services that are connected to data systems and registers in a customer-focused, purposeful and functional manner. These include appointment services, transmission of laboratory results, prescription renewals, payment and compensation services and various types of information services. These services are used to support citizen's decision-making in health -related matters as well as interaction and information flow between professionals. The services will enable self-service for citizens in those functions, where self-service is appropriate.

The objective of the national SAINI architecture is to standardise technical solutions and services of current and future electronic services. The architecture acts as a shared target for different interest groups and parties. The Road Map in the report describes the different stages of implementing the electronic services on national level. The first and the most critical stage is to link the SAINI services -concept to the national strategy for electronic health care services. The strategy provides clear definitions for the ownership, management, control and funding models of the services.

The SAINI service concept is to be developed in close cooperation with its users – citizens and health care professionals. The first stage will be about implementing the already piloted services, which have produced good feedback. In the second stage, services enabling the management of data related to the personal health of each individual will be introduced. Here, data widely covers all transaction data, data registered by professionals and data recorded by citizens themselves.

Compatible and interoperable SAINI services support the management of treatment entities across organisational boundaries, self-care, the renewal of health care structures and processes and the improvement of quality.

The final report has been prepared in cooperation with several persons and organisations. We want to extend our warmest thanks to the SAINI team and all parties for their enthusiastic and active participation during the SAINI project.

Helsinki, 31 October, 2008

On behalf of Sitra and its Health Care Programme

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1   INTRODUCTION

The work on the SAINI concept (1) (2) has taken the Government's resolutions and policies made by various bodies as its starting point:

1)   The Government Programme of Prime Minister Matti Vanhanen's second Cabinet (3) set out the following targets and guidelines:

"Steps will be taken to encourage the adoption of new technology and to increase transparency and guidance within the service system. Another objective is to improve the citizens' capacity for action and encourage initiative and civic engagement. Satisfied and competent staff provides the basis for the measures." (p. 45)

"A social and healthcare services innovation project will be carried out aimed at improving the citizens' initiative, civic engagement and capacity for action, developing the division of duties, the effectiveness of activities and services, improving cost-efficiency and expanding the diversity of services.... Additionally, the adoption of new technology and commercialisation and exports of technological innovations in the social and healthcare sector will be encouraged." (p.48)

2)   The Government resolution on the objectives of the National Information Society policy for 2007-2011 (4) states that:

An economical, reliable and secure national information technology infrastructure will be created for social and healthcare services enabling customer-oriented and cost-efficient provision of high-quality services.

By 2011 all public actors in healthcare services will have joined the national electronic archiving services for patient documents, and all healthcare actors and chemists' have access to e-prescriptions. Electronic customer information systems in social care will be updated in accordance with national guidelines. Support will be provided to citizens who take personal responsibility for actively maintaining their health and capacities. Flexible use of on-line services will also be supported. Citizens will be provided with information and interactive services concerning health promotion and medical treatment. (p. 4)

3)   The Information Society Programme ministerial committee chaired by Prime Minister Matti Vanhanen outlined the basic precepts of the national healthcare information system architecture in 2006 (5) (6). The work of the Information Society Programme continues within the Ubiquitous Information Society Advisory Board (7).

The Ministry of Social Affairs and Health is the key ministry and responsible of the national development of this architecture work (8). The precepts were incorporated into bills, which were submitted to Parliament and passed into law in December 2006 (9) (10). The legislation requires healthcare organisations to join the national information system architecture within a specified transition period; this architecture's essential services include archiving and distribution of electronic patient records, a national prescription database, an electronic certification service for healthcare professionals, and a maintenance service for classifications, codes and terminology. Detailed specification of these national services has been completed in February 2007, and the services will be put online between 2007 and 2010.

4) The Government Resolution on the Health 2015 (11) outlines targets for Finland's national health for the next 15 years. The main focus of the resolution is on health promotion.
5) The Ministry of Social Affairs and Health has established the IT Strategy for the Administrative Sector of the Ministry of Social Affairs and Health 2007 – 2011 (12).

The strategy is built around the principle of citizen-centred, seamless service structures. Among the main targets of the strategy were the horizontal integration of services (social, primary, and secondary care) and the development of shared, coordinated services delivered closer to home. Citizens and patients were envisioned as informed and participative actors in the healthcare delivery process. Since seamless services require seamless information access, utilizing information and communication technology became an absolute necessity in the realization of this vision.
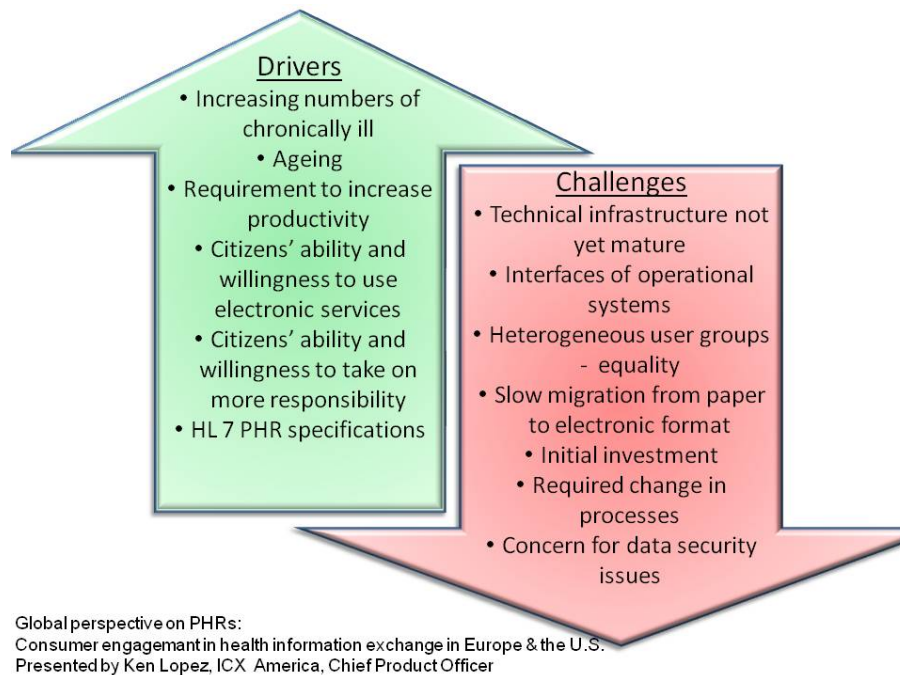
The creation of the SAINI concept is based on the above mentioned programmes and resolutions. It has been carried out in close co-operation with a wide range of organisations representing both national and municipal levels as well as public and private sectors. One crucial aim was to make sure that the development of electronic healthcare services fulfils the requirement of interoperability on all levels from semantic to technological interoperability.

The project began by analysing existing electronic healthcare services offered to citizen in Finland and in EU-countries. It was clear that the development of the first services in Finland was done from the respective service provider's perspective. This was leading to a situation, where the citizen would have to learn to use many different interfaces and user logics, depending on the organisation he was contacting and re-learn them when he moved from one municipality to another. One crucial element of the -concept is that it is created from the citizen's perspective. The aim was to ensure that all healthcare service providers would offer similar services with similar user logic. This way the citizen would need to learn to use the services only once.

The citizen's perspective demands a broad look on the services offered to citizens and on how public sector services are offered via browser. The citizen uses different services in different phases of life and the need for healthcare services varies as well.

Important drivers behind the SAINI–concept are the creation of the National Electronic Archiving Services of patient documents (KanTa) (13) (14) as well as the national project to restructure municipalities and services (PARAS) (15). KanTa provides a robust infrastructure and enables the creation of value adding services. PARAS –project requires the restructuring of services and thus there is a change in processes that enables implementation of electronic services.

Other drivers and obstacles to creating electronic services for healthcare are listed in the picture below (Picture 1).

Drivers
• Increasing numbers of chronically ill
• Ageing
• Requirement to increase productivity
• Citizens' ability and willingness to use electronic services
• Citizens' ability and willingness to take on more responsibility
• HL 7 PHR specifications

Challenges
• Technical infrastructure not yet mature
• Interfaces of operational systems
• Heterogeneous user groups - equality
• Slow migration from paper to electronic format
• Initial investment
• Required change in processes
• Concern for data security issues

Global perspective on PHRs:
Consumer engagement in health information exchange in Europe & the U.S.
Presented by Ken Lopez, ICX America, Chief Product Officer

**Picture 1. The drivers and obstacles for creating electronic health services (16)**

The SAINI concept is all about providing healthcare services to the citizen in a citizen-centered way. The first implementations of the SAINI concept focus on electronic healthcare services provided by the public and private as well as the third sector. The services that are traditionally considered as social services are left out, even if that is a bit arbitrary at the time of restructuring services. This is a wide and challenging area and it is wise to proceed in phases and steps. The concept will be enhanced and updated, when the first versions have been implemented and evaluated. eKat –programme is running some pilots and results are ready in June 2009 (17).

The SAINI concept aims to fulfil the requirements set for user-friendly electronic services. The idea of a 'one-stop-shop' was a strong guiding principle: The citizen wants one place, where all services related to not only healthcare, but other relevant services provided by the state and municipality can be obtained. The citizen should be able to customize the services interface according to his needs, phase in life and health status. It is crucially important that the services and their user logic remain the same, even if the citizen moves to another city or changes employer.

The services are classified into four categories, which are based on the citizen's processes described below in chapter 2. The services in the first category are those that require close interaction and transaction with a healthcare service provider's systems and staff. These services have often been designed primarily to support the service providers' process. The SAINI concept calls for a more citizen-oriented mode of design.

Second category services needed to be added to the transactional services to ensure support to the 'self-care' and the 'promotion of health' processes. The second category services can be called 'Personal Health Record Services'.

The third category services are information services, which can be considered crucial support services to the core processes described above. The fourth category services are the technical support services needed to run any electronic service. It is however important to note, that health care services require more in the area of data security and safety.
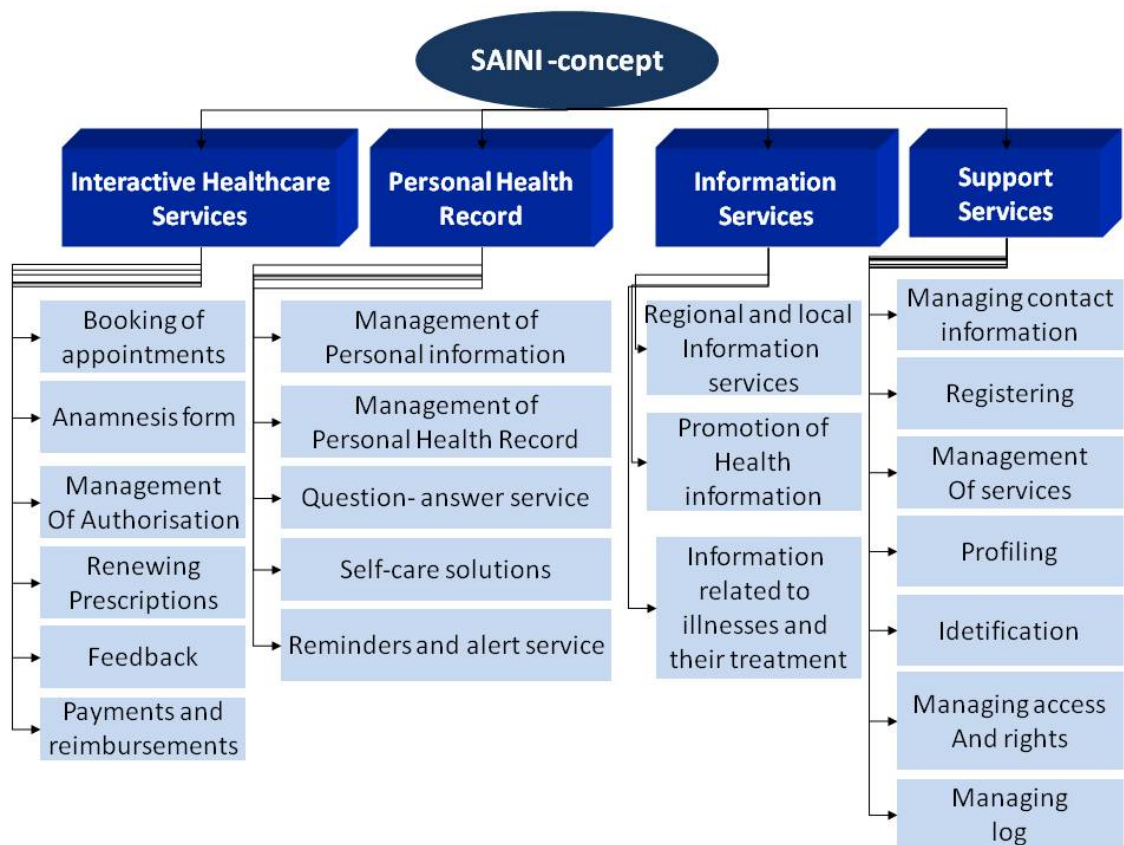
Picture 2. SAINI concept

Even though the citizen was the focus, when designing the concept, the needs and requirements of healthcare service providers and professionals need to be covered to make this a feasible and successful service. The services need to support healthcare service providers' processes in a way which allows increases in efficiency, efficacy, impact and quality.

Further development and enhancement of the concept will be carried out based on the results from eKat –programme (17). eKat is funded by the Ministry of Social Affairs and

Health and its target is to pilot electronic health services in seven public healthcare organisations (including four healthcare districts) around Finland.

2   BACKGROUND

The challenges in the healthcare sector are well known. Various development programmes aim at increasing productivity and the impact of healthcare service production. To gain in effectiveness, efficiency and impact it is crucial to make use of services enabled by modern technology. The –services support the citizen's healthcare processes, but need to be aligned with healthcare service providers' processes. From the citizen's point of view three 'core' healthcare processes and two supporting processes were identified. (Picture 3):

Picture 3 Healthcare Processes from citizen's perspective

"Healthcare process" is the traditionally familiar process that is **owned and managed by a healthcare service provider's professional staff**. The main responsibility in this process unquestionably lies with the healthcare professional. In the future, the process will be a bit different due to electronic services. Electronic services make it possible for the citizen (or patient) to take on some of the routine tasks. The information created and used in the process is owned and managed by the healthcare provider and its professional staff. It is stored in patient information systems and electronic health record systems as well as other operative systems of the provider. Parts of the information are archived in the National EHR Archive Service.

"Self-care process" is a process that is **supported by the healthcare service provider and/or third sector. In this process the citizen has an active role and takes on some of the responsibility.** The process is often initiated and controlled by a healthcare professional as for example in treatment of the chronically ill or in rehabilitation, but this process covers other self-care actions as well. Information in this process is created by the professional but mostly by the citizen and patient. The citizen needs to record various measurements and other facts as well as subjective comments and observations related to the specific self-care. There is often some kind of software solution specifically designed to support the care of certain illnesses. It is in this kind of processes, where the information created by the professional and the information created by the patient mix and it is crucially important to make who created which piece of information transparent and clear.

"Promotion of health" processes cover activities that are planned, carried out and controlled by the citizen himself as well as activities that are initiated, supported and/ or controlled by third sector and other peer groups or even governmental health promotion programmes. **These processes are owned by the citizen**. **The citizen owns all data created in these processes and decides how to use it**.

There are similarities in the 'self-care' processes and 'promotion of health' processes. In both processes the activity of the citizen is a crucially important success factor. In both processes there is a target and a plan how to achieve the target. Electronic services enable innovative ways to set out plans and to follow up the progress and the outcome. Electronic services enable support from healthcare professionals in a flexible and time-saving manner. Electronic services also enable support in the form of software with some built-in intelligence. The main difference in the processes lies in the degree of responsibility the citizen can take. In the 'promotion of health' process the citizen owns the processes and is responsible for them.

All processes described above need validated, easy-to-understand information about illnesses, treatments, services, professional care takers and other matters related to healthcare and health promotion. Information can be actively published ('pushed') in the user interface depending on user's profile or the user can search ('pull') for information.

The services described in the SAINI concept need to be created and implemented in phases and in close co-operation with users. Feedback from all user-groups needs to be solicited regularly. Some of the proposed services have already been piloted in regional projects with encouraging feedback from users. We propose that the services, that have been piloted, will be 'standardised' and implemented nationally in the first phase. Development of services in the second phase would focus on the creation of self-care services and of Personal Health Record services in particular.

3   EXPECTED BENEFITS

In the area of implementing electronic services, most benefits derive from one of the following three sources: 1) Some manual tasks do not need human intervention any more (they are carried out by the system), 2) Some operations will be done more efficiently and effectively (better and/or integrated systems) or 3) Partly or totally new operations are enabled by new technology (more preventive care).

The benefits derived from the Finnish eHealth pilots so far are mostly in the first category: some manual tasks can be done by the systems. Thus the changes in operations or processes have not yet been considerable. As we implement solutions that bring about changes in the other two categories, there will be more substantial benefits.

The benefits are a result of interrelated changes on operational and organisational levels. Below is an illustration (Picture 4) of a benefit map, which visualizes the complex network of changes that need to take place for the realization of benefits. The creation of the benefit map makes the chain of required changes transparent. On the left-hand side we have the enablers, which consist of technical solutions and people's competencies. Technical solutions enable changes in everyday work and tasks. These changes in interrelated chain of everyday tasks enable a process change, which can lead to benefits. We can use this logic, when we establish measurements to proactively monitor and check that change at all levels is taking place to achieve the benefits.
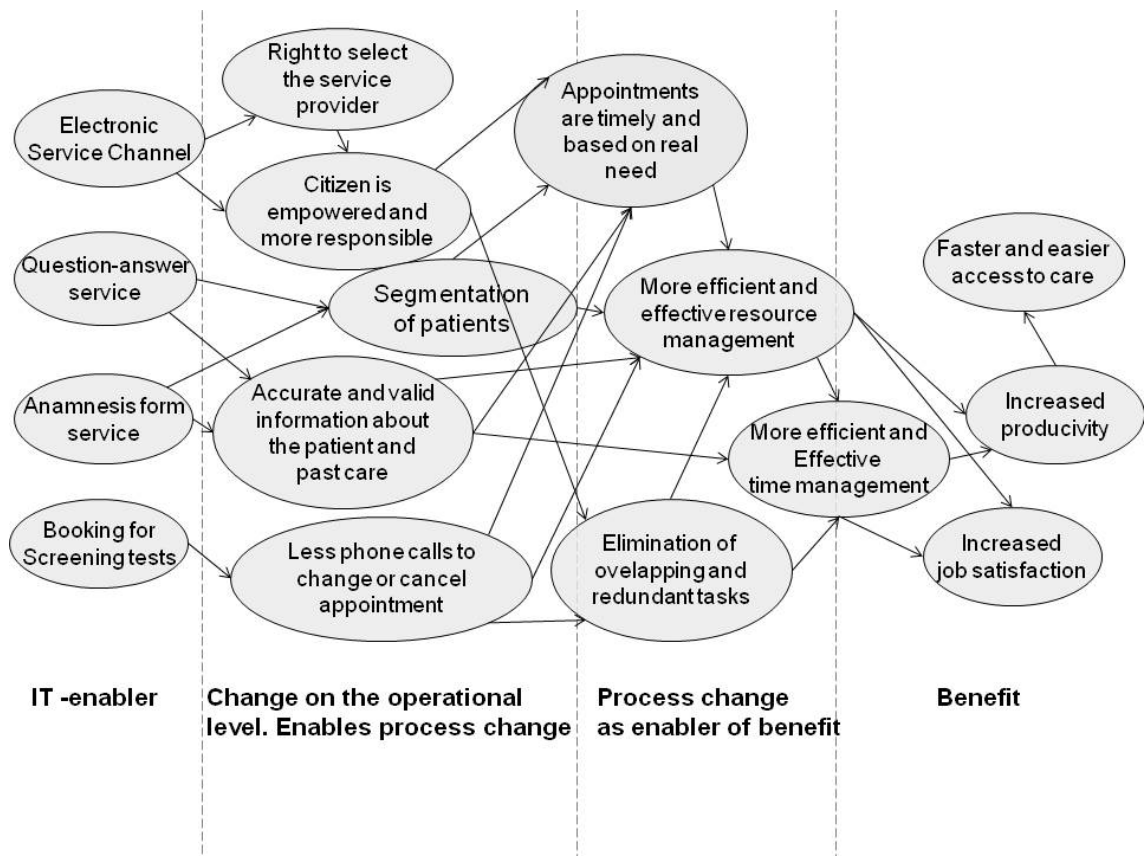
Picture 4 Map of changes required to produce expected benefits

Once we have the technical solutions as enablers in place, we need to learn and start doing things differently.

Related to increased productivity a rough cost-benefit analysis was carried out related to services of the SAINI concept. The estimate of savings was 30 Euros per citizen per year. This estimate is in line with the calculations carried out in various projects in EU. Also the estimate, that the benefits will be realized in 3-4 years after implementation, is similar to the findings in projects in EU (eHealthImpact) (18). It is important to understand that the benefits to be expected vary a lot according to the patient segment. For example, it is estimated that using electronic healthcare services in the treatment of the chronically ill will bring substantial benefits.
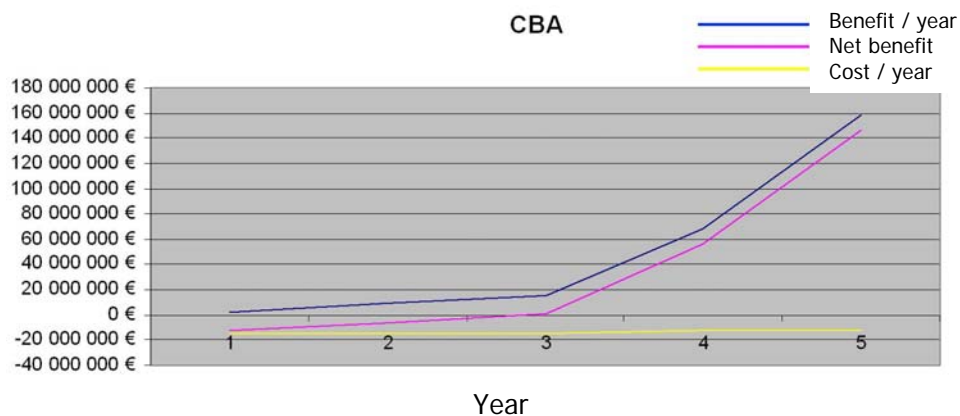
Picture 5 Cost-benefit analysis

'eHealth is Worth it' survey by Health Impact studied benefits of electronic services in 10 projects related to healthcare in EU. In all cases the benefits had their roots in more timely, efficient and effective information transfer between the parties. The most radical changes were in information transfer and communications. The change in form, flow, quality, structure and presentation of information not only made the processes faster and smoother but also enabled process re-engineering (19). One benefit of implementing electronic services was that they enable more effective use of existing capacity and resources. The report emphasizes the importance of redesigning processes to fully maximize the potential of electronic services. The new technology alone will not bring benefits. Changes in behavior and processes are required to bring benefits. These changes are slow and the investment in electronic services must be considered as a long term investment.

The benefits will emerge, when most of the SAINI concept's services are implemented. We argue that the service –concept is more than the sum of the various service modules. To keep users and owners motivated it is important to try and find quick wins in the first phase. Often the first phase of development of electronic services covers information services and some communication tools and the more advanced transactional services are not implemented until later (Picture 6).
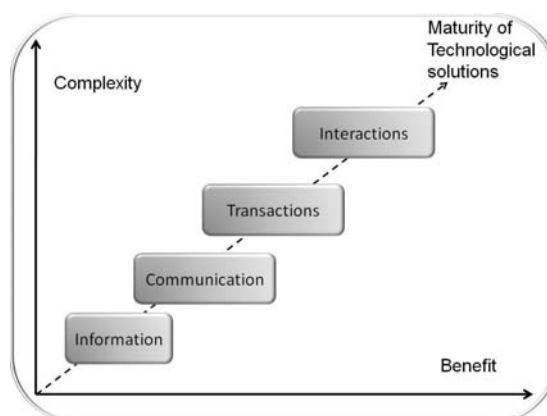

Picture 6 Complexity and benefits of electronic services

The more advanced services of a transactional nature require integration into the various operative systems used in healthcare sector. Integration and more importantly interoperability of the systems is crucial to bring the expected benefits and targeted results related to impact and efficacy. Integration and interoperability are required to ensure that the relevant and valid information flows through the healthcare ecosystem in a way that enables efficient and effective care processes.

Many pilots have increased our understanding of the changes that are the root and origin of the benefits:
- Citizens acquire and receive better quality and easy to understand information about their own health and illnesses. This leads to better understanding of one's own health status which in turn may result in taking greater responsibility for one's own health.
- Enable more informative decisions related to healthcare.
- Electronic services enable and encourage more active self-care.
- Enable easy and flexible communication between healthcare professional and citizen.
- Enable easy and flexible ways to guide and inform citizens.
- Enable and support information flows across organisational boundaries.
- Enable self-service in some routine tasks

The results of various surveys conducted in the EU are supported by national studies. The Health II – programme asked some municipal health centre doctors how they perceived the benefits of specific electronic services to patients. (20) 40–50% of doctors in municipal healthcare centres agreed that the following services bring benefits to the patient: transmittal of laboratory results, renewal of prescriptions, making appointments, safe channel for communication and transmittal of some electronic forms. (Picture 7)
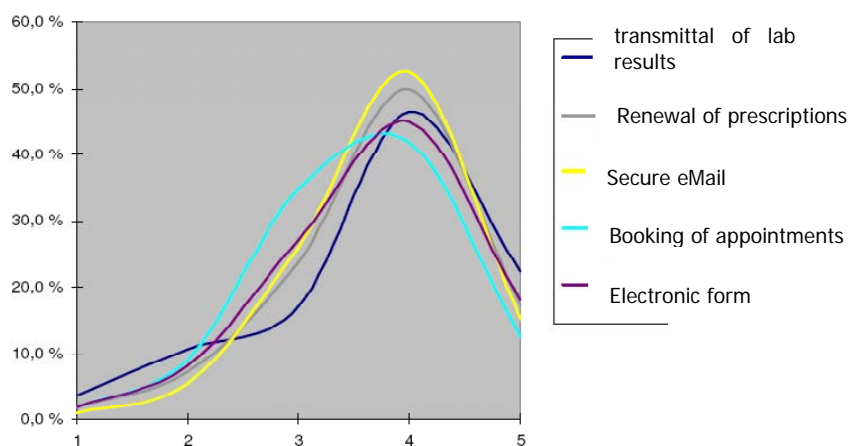
Picture 7 Benefits of specific electronic services to patients (20)

Besides national pilots several international (EU and the U.S.A.) plans and implementations have been studied, e.g. IZIP (21). A lesson learnt was that when creating first services it is not enough to estimate what benefits each service module brings. It is important to consider which segments would benefit from the services the most. It is the chronically ill who most probably benefit from the services and quite soon. In Finland it has been estimated that this segment as a whole is 20 % of population and 80% of the expenses. Thus the first phase needs to focus on certain segments to make sure the benefits gained encourage further development and implementation.

The same doctors were asked to assess the usefulness of the same services to the staff of the municipal healthcare centre (Picture 8). Transmission of electronic forms and of laboratory results was considered as especially useful for the staff.
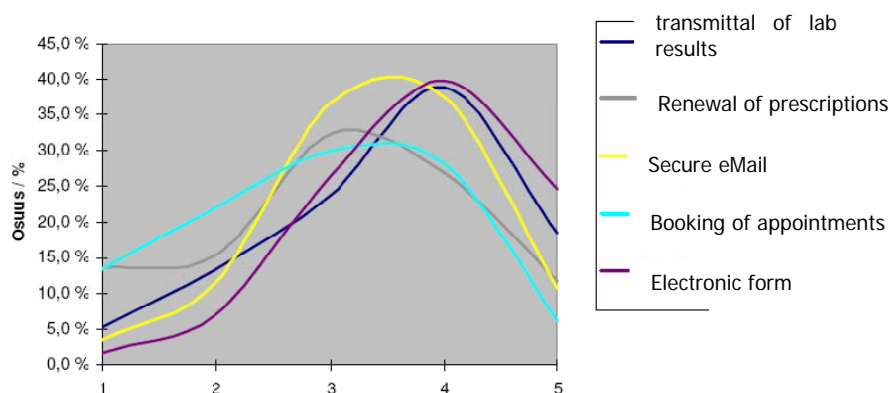
Picture 8 Benefits of specific electronic services to the professional staff of a municipal healthcare centre (20)

4 CONCEPT

The services can be classified into four categories: 1) Interactive electronic healthcare services, 2) Personal Health Record and self-care, 3) Information services and 4) Support services.
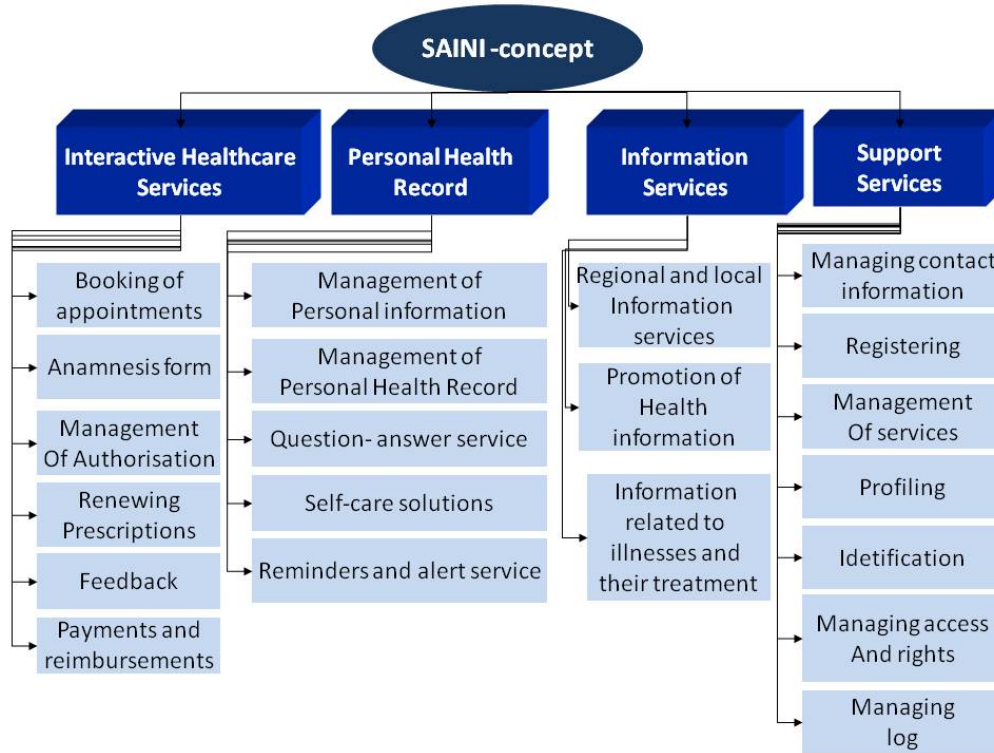
Picture 9 SAINI service concept

The essential nature of the concept is in line with the Markle Foundation's definition of electronic Healthcare solutions:

> *"An internet-based set of tools that allow people to access and coordinate their lifelong health information and make appropriate parts of it available to those who need it."*
> *The Markle Foundation's Connecting for Health Collaborative* (22)

Services in the category "Interactive electronic healthcare services" are the services that have traditionally been provided by the healthcare service providers via posted documents, face-to-face and telephone. Most services are the same, but offered via a new channel. There are not many innovative services in this category in the first phase.

The services classified as Personal Health Record Services:
- are tools for managing information relevant to citizens' lifelong health and wellness
- allow citizens to manage their personal health information
- contain information that is owned and primarily used by an individual patient
- contain information provided by the individual and by the care taker
- can be accessed anytime, anywhere via the Internet

Implementation of Personal Health Record services (PHRs) in electronic format supports national targets related to health promotion by enabling citizens and patients to engage more actively and to empower them to play a larger role in wellness, self-care, and disease management, with important dividends in quality improvement and cost containment.

In order for personal health record services to have an impact on citizens' health and thus expected benefits, they must be integrated to exchange data with healthcare information systems. These systems are the service providers' operative systems, National Electronic Health Records Service, pharmacy and laboratory data systems, and devices supporting self-care at home. Personal health record services collect and consolidate patient information from a variety of sources and provide a comprehensive view of relevant health information for both citizens and authorized healthcare professionals.

There are clear differences between a Personal Health Record and an Electronic Health Record. A Personal Health Record is owned and controlled by the citizen and patient while an Electronic Health Record is owned by the professional healthcare service provider. An Electronic Health Record is a legal document and there are strict rules for how information is created, edited or deleted. A Personal Health Record is not a legal document. A Personal Health Record supports patient-directed healthcare by providing information and tools that will lead to greater interaction between patients and their doctors. More importantly, with authorisation, professional healthcare staff can have access to the patient's personal health record or parts of it giving them a new, expanded and systematic way to interact with patients on the care they receive.

5   ROAD MAP

The Ministry of Social Affairs and Health has defined Finland's strategic choices which steer the development work (23)

1. To ensure the availability of information for patients undergoing treatment, regardless of time and place, in both public and private healthcare. The means to achieve this include comprehensive digitization of customer data, development of the semantic and technical compatibility of electronic patient record systems for the entire content of patient records, development of the national healthcare infrastructure and information network solutions, identification and authentication solutions, electronic signatures, and maintaining online information to support decision-making.

2. To enable the participation of citizens and patients, and ensure that citizens have access to more information and to high-quality health information. The means to achieve this include development of a citizen's health information portal, access for citizens to their own patient records, health information and log data, and development of e-services (booking of appointments, e-discussion, e-document transfer, online consultation).

Many organisations are developing electronic healthcare services and some services have already been launched internationally and locally in Finland. A crucial project in Finland is the National Electronic Health Record Archive KanTa, which will enable creation and implementation of other services (24).

Even if the National Electronic Health Record Archive KanTa Service is created with healthcare providers' processes and information transfer requirements in mind, it will form the core of the services offered to the citizen as well. The service gives the citizen read-access to his own 'official and legal' healthcare data over the internet. SAINI concept has this service in the centre and builds value-add services on top of it.

There are three organisations which work on the development of the technical solutions and principles needed in implementation. These organisations are 1) Local Government IT Management Unit (Local government IT management unit Unit) (25), 2) The State IT management unit Co-ordination Committee (26) (27) and 3) The Ubiquitous Information Society Advisory Board (28).

The municipalities are responsible for the provision of healthcare services. The Local Government IT Management Unit (Local government IT management Unit) is an organisation, which co-ordinates development projects by the municipalities. Local government IT management unit Unit has started work on modelling service processes to support the restructuring of services. The unit is also investing in the development of interoperability (architecture). Projects in 2008-2009 in this area are:

- Service Oriented Architecture in Finnish Municipalities
- Technology standards and Best Practice on how to implement them
- Enterprise Architecture Models for Finnish Municipalities
- SOA implementation –project
- Service portal implementation –project
- Common support services for the Municipalities' eServices

The State IT management unit Co-ordination Committee, together with the State IT management unit Management Unit, prepares proposals on common IT services and architectures of State administration. The Co-ordination Committee monitors the implementation, use and quality of common IT services. A new electronic service for citizens will be implemented in 2008-2009. The service gives the citizen easy-to-use access to all services provided by the state. The implementation of the service will include creation of some crucial support services.

It is the task of the Ubiquitous Information Society Advisory Board to ensure that the national information society strategy drawn up in the previous government term will be put into practice. The work within the Ubiquitous Information Society Advisory Board is carried out in six working groups. One of the working groups is the Information security working group. The group's task is to outline a new national information security strategy and coordinate its implementation. The working group's term of office ends in February 2011. Another group is the electronic identification development group, which aims to promote common electronic identification systems for the public and private sectors. The group will convene until February 2011. The third working group focuses on Electronic Invoicing. The group's objective is to accelerate electronic invoicing in the public and private sectors and introduce it to consumers. The work in all the three groups has an impact on the implementation of the concept.

The eKat- programme (financed by the Ministry of Social Affairs and Healthcare) pilots some of the services in the concept. eKat co-ordinates development and piloting of electronic healthcare services in seven organisations (mostly healthcare districts with secondary healthcare services). Common and shared principles for the services of the concept will be defined in more detail based on experience from the pilots.

Lastly, the development of information services by the National Public Health Institute (KTL) and Duodecim will be closely linked to the implementation of these services.

The roadmap has been drawn up the projects summarised above in mind.

The creation of - electronic Healthcare Services will be done in small manageable steps or phases. Besides linking to the development programmes mentioned above, the scheduling is based on various criteria:
1) Benefits to be expected
2) Risk management,
3) The maturity of required electronic solutions
4) Technologically cost-efficient and sustainable development path.

The solutions that will be created and implemented in the first phase have already been piloted in several organizations and in various formats. This means that the technical solutions have been piloted and tested and have the required degree of maturity. The pilots have shown some proof of benefits though not yet to the extent that is expected when the service is fully implemented.

In the first phase the services will be created mainly for public sector needs. The private sector already has electronic services in place. They will be integrated with the services of the public sector once some crucial issues related to authorisation and identification have been solved.
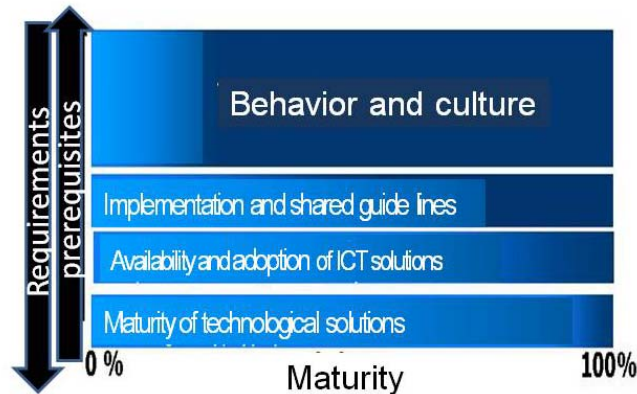
5.1 Time table

In Finland in 2007–2011 the objective and focus of information society politics in the area of social and healthcare services is to implement and develop ICT architecture and infrastructure, which enables production of high-quality services in a customer-oriented and cost-efficient manner.

By 2011 all public healthcare providers will have been integrated in the National EHR Archive Service and will be set up to start ePrescriptions. The operational systems in the social sector will be developed according to national guide lines. The aim is to support citizens' initiative and activities to maintain their own health and to offer a flexible network of services as part of preventive care.

The technical development of electronic healthcare services will be synchronised with the implementation of the National EHR Archive Service and with the development projects by the state and municipal ICT organisations. In addition there are the information content development projects by Duodecim and The National Public Health Institute (KTL), which need to be coordinated.

As to the required organisational and operational changes, the reorganisation of primary and secondary care as well as the "PARAS" –programme (project to restructure municipalities and services) drive change, which gives a good opportunity to consider electronic services as part of the new processes. The restructuring of services will mean designing processes that cut across traditional organisational boundaries and for these electronic services is an enabler. In connection with restructuring service processes the tasks of various organisations and the roles of professionals need to be reconsidered. Citizens and patients can take on a new, more active role now that there are systems to support them.

The change in processes takes much longer than the change in systems. The required technological solutions are mostly already there. Below (Picture 10) is an illustration of the maturity levels of the various aspects that need to change. It is clear that the technological solutions are quite fast to create and produce compared to the time needed to change behaviour and culture. Mr. Aimo Maanavilja presented the illustration at the ICT workshop of the Finnish Funding Agency for Technology and Innovation (TEKES) (September 25th 2007).

Picture 10 Pace of change (29)

The national projects for restructuring primary and secondary care and the restructuring of municipalities and services both have an effect on the implementation schedule. Besides these timetables, we must consider the expectations of user groups; healthcare professionals and citizens. All development should be done in close co-operation with the users of these services.

As to surveying opinions of future user groups, not much has been done. According to a survey conducted in the Health II- programme, primary care doctors expect electronic health services to be developed and implemented in 2-5 years' time.
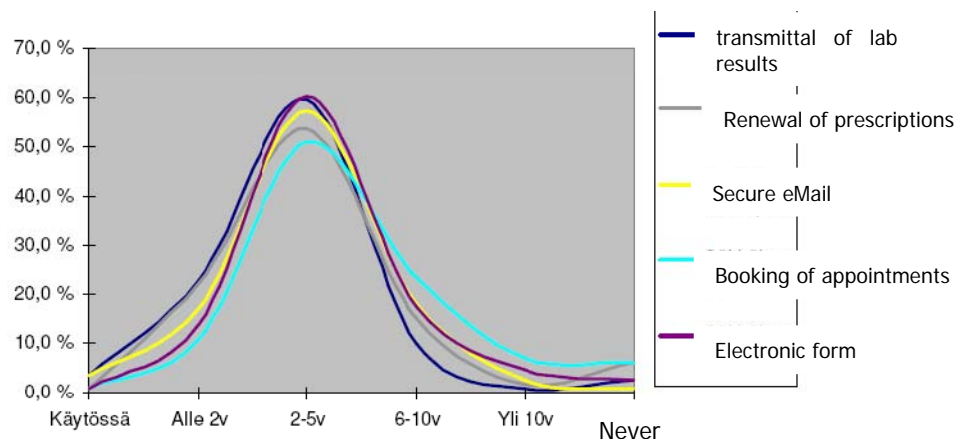

Picture 11 Primary care doctors' expectations on the implementation timetable (20)

In the area of secondary healthcare the potential services to be offered through electronic channels were identified in 2006 as: Appointments, recording of critical patient data (medication, allergies, operations, etc.), check-in into the care unit, communicating laboratory test results to patient, personalized instructions for care, patient satisfaction and impact of care (15D) questionnaires. (30)

The available solutions in the market and their maturity must also be considered, when drawing up the timetable. Google and Microsoft have launched "Personal Health Record" products. Microsoft's solution has been localized by Medixine to fit better in the Finnish environment. Duodecim has also launched its own solution. Besides commercial solutions, municipalities and healthcare districts are in the process of developing solutions of their own. From this can be concluded that service providers have identified the need and are prepared to respond to it. It is now important that shared and common guidelines are decided upon to avoid development being too heterogeneous resulting in a jungle of solutions forcing users to learn many different user logics as they move or change jobs. In addition to this user perspective, it is important to join efforts to ensure as cost-efficient development as possible in Finland.

The road map needs to be updated as decisions are made related to the ownership, financing and management of the service concept.
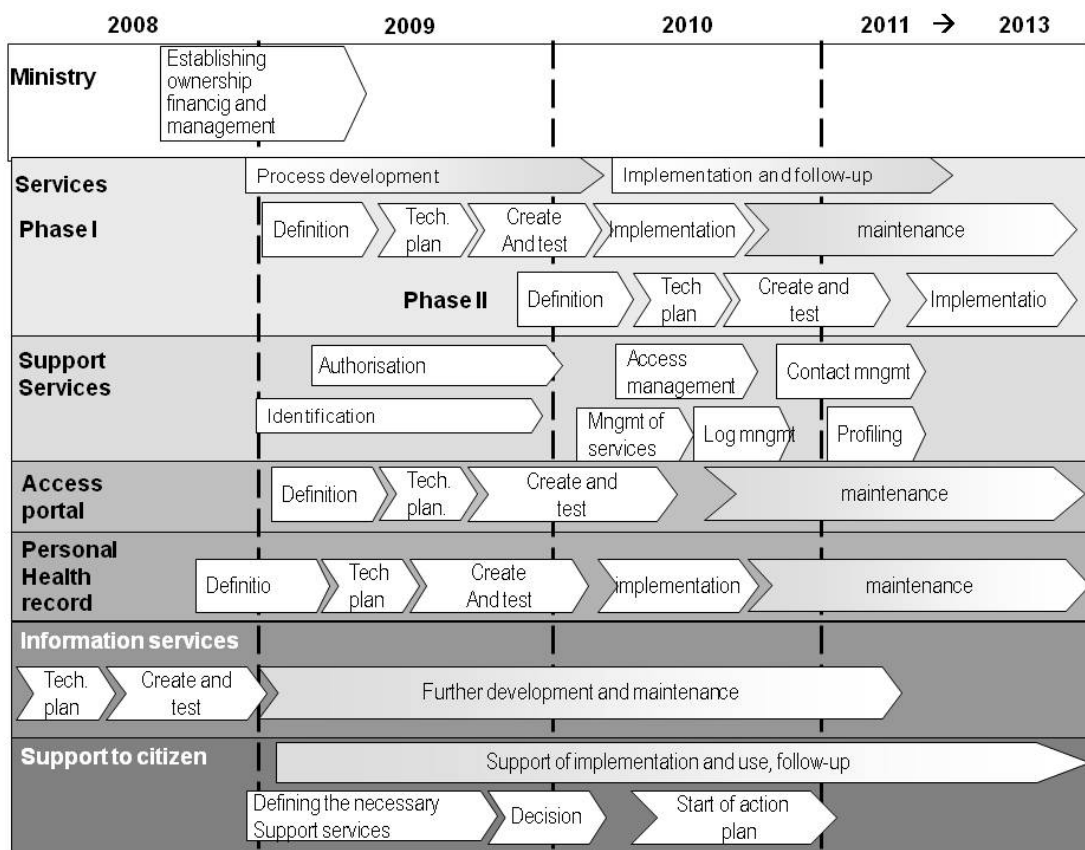
Picture 12 Road map

6 PHASE I

To make implementation of the road map a success it is critical to form a clear and shared big picture of electronic healthcare services with all the levels and aspects of the service. The first task is to decide on ownership, financing and the governance model (Picture 13). The architecture of electronic services must then be documented, based on the architectural planning, by the Ministry of Finance. As well as preparing economic and fiscal policy, the ministry is responsible for the overall development of public administration. Electronic healthcare services are just one subgroup of services for the citizen.
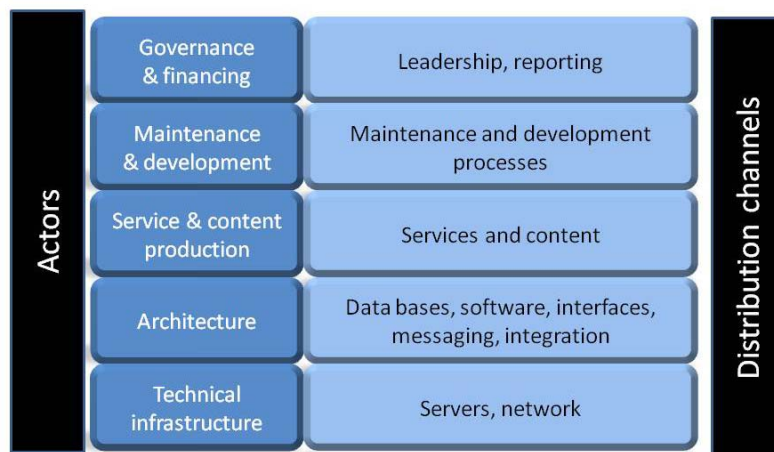
Picture 13 Areas that need to be specified at the start

The approach to defining the national strategy for electronic healthcare services is mostly "top-down" work. This approach needs to be complemented by a bottom-up approach. By this we mean feedback and input from various local pilots into the strategy work. The eKat –programme coordinates the various pilots and documents the experience and results to be used in the strategy work.

The strategy will define ownership and roles as well as responsibilities in developing electronic services. The role of the Ministry of Social Affairs and Health in steering information management in the healthcare and social welfare sectors is strong. The Social Insurance Institution (KELA) manages the national electronic archiving of patient records and a national prescription database. The National Research and Development Centre for Welfare and Health (STAKES) is responsible for maintaining the national code service and The National Authority for Medicolegal Affairs (TEO) for maintaining the certification service for healthcare professionals.

The functions of the Ministry of Social Affairs and Health in implementation of the national information system architecture are as follows:

1. Managing overall steering of the process, for example by taking responsibility for steering national development projects and information system services provided at national level
2. Managing the drafting of legislation
3. Managing preparation of the central government budget and steering of the principles underlying the service-financing mechanisms
4. Governing the preparation and maintenance of national guidelines by commissioning expert assistance
5. Assuming responsibility for the national healthcare data security policy and its implementation
6. Assuming responsibility for steering the information system architecture, for example by supporting the migration of regional systems to the national architecture
7. Managing communications
8. Managing the strategic steering of information management in the social welfare and healthcare sectors together with other ministries (including local and central government IT units)
9. Assuming responsibility for international strategic cooperation

The city or municipality is responsible for providing healthcare services to its citizens. The healthcare services are practically free of charge. Therefore electronic transactions should also be free. This creates a challenge at the investment phase. However, the service oriented architecture enables the creation of some services in such a way that citizens feel they get extra value and therefore are willing to pay for them.

The municipality can buy the technical creation and production of services from outside, for example from healthcare districts owned by the municipalities. This would build regional knowhow centres of electronic interaction and keep expenditure at an effective level. Another option is for a service model where all electronic transactions are provided by the National Electronic Health Record Archive Service.

The financing and production of the services in the first phase should be coordinated and controlled, but distributed. By this we mean that the service providers could make use of centrally created services (created on top of the National Electronic Health Record Archive) or create their own services based on shared common standards and guidelines. The latter might not be economically feasible.

A decision about service model structures must be made on a national level before starting to build the services on a greater scale. At one end is a model where standards are created for each service provider to use as guideline. At the other end is centralized implementation.

Deciding on ownership and defining the operational and administrative model takes time and the work on more detailed specification of services needs to get started.

Solutions to enable electronic services should be built as drafted in the national architecture and complement the services of the National Archive. Citizens should be given reliable information on health promotion; the symptoms and treatment of illnesses; service providers in the public, private and third sectors; the content, availability, cost and quality of services and their benefits. Interactive electronic services are also needed; such as

appointment booking, sending and receiving structured information related to care (laboratory results and anamnesis forms), consultation, Q&A, virtual discussion forums, self-care systems for chronic illnesses, etc.

A restricting aspect is the still unresolved matter of patient information disclosure (patient consent) in electronic format. The operating unit, which maintains information only, is the legal owner of the data register. Thus management of information disclosure is unduly complicated.

The services to be specified or implemented in the first phase are:
1) Specification of Personal Health Record Services
2) Emergency Data Set (specified on the EU-level)
3) Booking of appointments
4) Anamnesis forms with basic patient data
5) Secure messaging service to enable questions and answers between professional healthcare staff and the patient
6) Validated information services

The support services required for the first phase are:
1) Secure identification and authentication of the user
2) Security and access control

A crucial requirement for the first phase is that all services are made reusable and interoperable as defined earlier with regard to Service Oriented Architecture.

6.1 Personal Health Record Services

Even though personal health record services will not be implemented as a whole in the first phase, the requirements they set as a crucial element of the concept have to be identified and documented.

Some of the first services (e.g. transfer of laboratory results, anamnesis form, question-and-answer service) are part of personal health records and have the same information architecture and structure.

The first implementation of the information architecture must provide a good base for future development and enhancement. HL7 has published release 1 of the PHR – system functional model. This model structures personal health record services as follows:

Personal Health	PH 1.0 Account Holder Profile
	PH 2.0 Manage historical clincal data and current state data
	PH 3.0 Wellness, preventive medicine and self care
	PH 4.0 Manage education
	PH 5.0 Account holder decision support
	PH 6.0 Manage encounters with providers
Supportive	S 1.0 Provider management
	S 2.0 Financial management
	S 3.0 Administrative management
	S 4.0 Other resource management
Information infrastructure	IN 1.0 Health record information management
	IN 2.0 Standards based interoperability
	IN 3.0 Security
	IN 4.0 Auditable records

Picture 14 HL7 PHR – system functional model, release 1 (31)

Some of these services that are part of the personal health record concept will be implemented in the first phase. However, the concept itself needs to be specified in more detail, and this work should start in the first phase. Specification of the PHR services needs to be done in a way which considers legal issues carefully.

The centralized archive system will enable patients to view their own data and usage logs related to that data. This will enable citizens to take a more active and responsible role in maintaining their own health and, with the guidance of professionals, in their own medical treatment. Centralized archive services make monitoring (including real-time statistics) and management much easier and open up new opportunities for research. International cooperation is easier to organize when the national system is uniform. Uniformity also means that the IT infrastructure can be built cost-effectively while ensuring a high level of data security.

The information in the Personal Health Record covers both general and contextual information. Personal information is created by the citizen himself, but also includes copies of information in official documents. The target is to compile information relevant and useful to form a coherent and clear understanding of one's own health status:

- The basic patient data
- Authorisation / consent for disclosure information
- Information about past and future appointments
- Laboratory results
- Prescriptions and medication
- Diary of symptoms
- Information about self-care
- Messaging history
- Copies of, or access to, Electronic health records
- Information about the healthcare service providers
- Other official forms
- Usage log

6.2 An Emergency Data Set

An emergency data set should be understood as the minimum set of data about a patient which allows healthcare providers to act in an emergency, and/or provide continuity of care in another country or provide unscheduled care when needed outside the home country or region of the patient.

The emergency data set will be created only at the citizen's request, respecting his/her right to privacy. The information contained in the emergency data set has yet to be agreed upon, but it will include a summary of essential information such as blood group, known allergies, medical conditions and details of medication the patient may be taking.

The key objective is to allow patient access to his/her important information stored in electronic health record systems anywhere at any time.

6.3 Booking of appointments

There are some Finnish booking services and projects piloting booking services in some simple forms (32) (33) (34) (35) (36) (37) (38). The operating model for a more comprehensive national booking service will be defined. The service is targeted at citizens and aims to make booking easier by providing a single point of access to all public service providers. The citizen can create, edit and cancel bookings via electronic service.

Booking of appointments is a service many citizens will appreciate. This service will first be opened for the various screening test appointments, where large numbers of citizens need to book an appointment. Synchronization between the calendars of the national electronic service and the service providers' systems can be manual in the first implementation phase. All the available time slots are first booked in the service providers' operative systems and are then made available in the booking service. The next step will be to implement automated synchronization based on HL7/SerAPI interfaces.
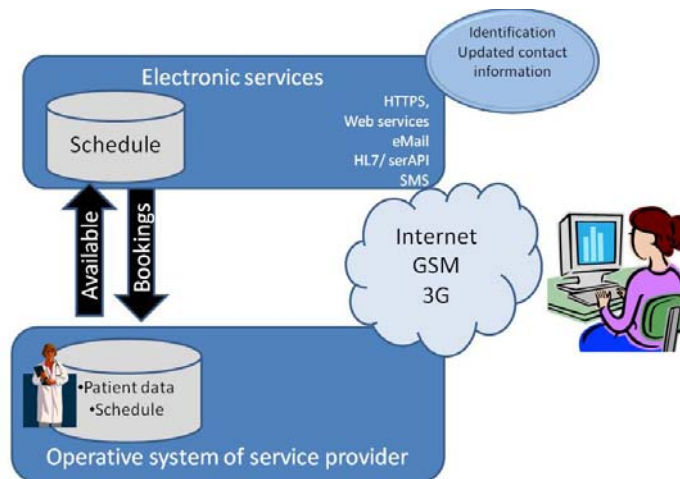
Picture 15 Logical architecture of booking appointments

6.4 Anamnesis form

Filling in the Anamnesis Form in advance enables better planning of the appointment and because it is done in electronic format by the patient himself, it reduces errors. An electronic service enables value adding services such as attaching additional information and advice, which can lead to better informed patients.

There have been projects piloting the anamnesis form in the Hospital District of Helsinki and Uusimaa and elsewhere. There are mature solutions for creating web-based forms, but there are great challenges in interoperability of content, structure and technology. The creation of this service requires more than offering forms in electronic format.

The anamnesis form service can be implemented in phases (39).
1) Patients can find the forms over the internet, print them, fill them in and take them to the service provider.
2) The patients can fill in the form over the internet and submit it electronically.
3) After identification and digital signature solutions are in place more sophisticated forms can be filled in and content transferred directly into operative systems.

The service related to the anamnesis form in its first implementation should be based on standardised content and structure of the forms that are most frequently used. Currently the anamnesis form for the same purpose and operation varies greatly among service providers. The first step in the creation of anamnesis forms is to agree on content and structure. The specification must follow CDAR2 guide lines. Integration into the operative systems is crucial.

The logical architecture of the Anamnesis Form service is shown in the Picture 16. Standardization of the content of the form is a requirement to make this service feasible.
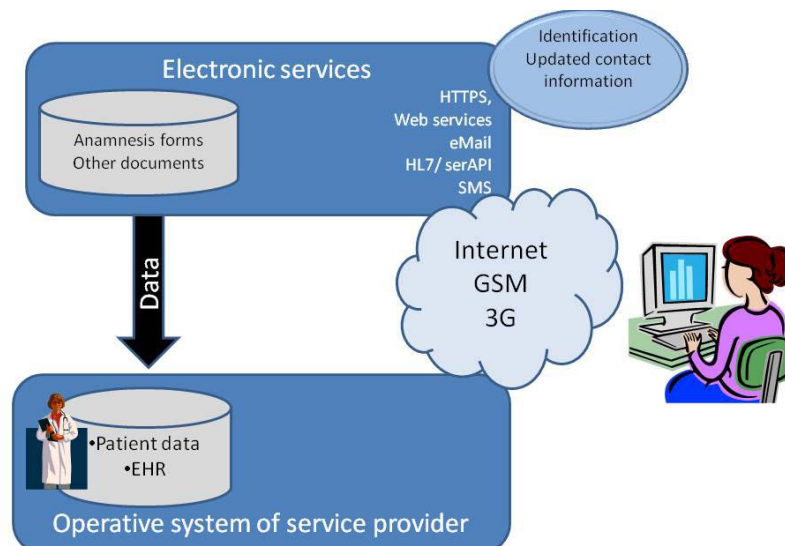
Picture 16 The logical architecture of the anamnesis form service

6.5 Question-answer service

The question and answer service resembles email-solutions or discussion forums, but requires sophisticated security and interoperability with operative systems.

The service is basically all about citizens asking for advice or more information and healthcare professionals giving answers and guidance. The citizen can ask questions anonymously or as identified patient. The latter is part of the core of personal health record services. One important use of this service is for supporting home care or self-care of the chronically ill. If healthcare professionals can establish close interaction with the chronically ill and support their home care measures there will be great benefits.

These kinds of services have been piloted in eKat –projects. A Question and Answer (Q&A) service can be implemented using a messaging solution based on XML. The citizen would use a web browser for messaging. The required security can be implemented with for example an XACML-description language and other security standards. The data in the messages should be transferred to the patient information systems using standard interfaces.

6.6 Validated information service

SAINI information services offer validated healthcare related information. These services support the other services by providing the citizen with necessary information. The information services will also lead to improved "health care literacy".

There are currently three organisations which offer validated healthcare information or information supporting promotion of health: 1) National Public Health Institute, 2) National Research and Development Centre for Welfare and Health and 3) Duodecim (The Finnish Medical Society). The concept calls for centralised content management and distribution of validated information services to ensure cost-effectiveness and quality in such a small language area as Finland. Centralised management ensures that the distribution of information to relevant target groups is done properly and proactively.

The Public Health Institute has already piloted a content management system with a network of validated information producers and content creators. The operating model of the HealthFinland Portal (tervesuomi.fi) service (40) collects health-related content from research institutions and expert bodies, authorities and organisations and delivers it via one centralised channel at www.tervesuomi.fi. The objective of the service is to help ordinary citizens, health professionals and communities make informed health promoting decisions. The portal is also aligned with the EU-level objective of making reliable health information more accessible to all people. The objectives of the tervesuomi.fi – portal are:

- Support healthcare and actions aimed at promoting health.
- Creation of information and content in a way that leads to better quality and cost-efficient use of scarce resources.
- Ensure that the citizen can obtain accurate and timely information on health issues
- Ensure the quality of healthcare information by creating a standardised validation process
- Make sure the scarce resources of a small country and language region are optimally used
- Provide organisations that have valuable knowledge with a content creation platform, publishing process and distribution channels.

The Finnish Medical Society Duodecim offers information services via the terveyskirjasto.fi (41) and www.terveysportti.fi (42), a health portal for professionals. Terveysportti.fi links local implementation programs directly to the relevant guideline.

The terveyskirjasto.fi service is financed by SITRA (the Finnish Innovation Fund), The Finnish Medical Society Duodecim, and Finland's Slot Machine Association (RAY). Thus the service is free of charge for the citizen until the end of 2008.

The information service supports care at home by providing a wide range of information to the citizen. One section is called 'the evidence-based current care guidelines'. All current care guidelines and evidence summaries in Finnish are freely accessible via the Internet. The electronic version allows linking guidelines to locally developed implementation programmes or shared care models. The dissemination of guidelines includes a wide variety of publications directed at specific audiences.

Information services can be implemented by linking the web pages of service providers to the services of National Public Health Institute and Duodecim. The service concept calls for automated update of citizens' own pages using RSS feeds.

The mechanisms for managing and updating the information services are based on the solutions of the Tervesuomi Portal of the National Public Health Institute. Also the technical capabilities of Duodecim need to be taken into account.

6.7 Registration

Implementing a shared system for registration to be used by service providers needs to be done in the first phase. The registration points (and databases) are distributed and controlled by the service providers. A minimum requirement is uniform content and user interface. There are several registration systems already in use. The recommendation is to use a commercial off-the-shelf solution.

6.8 Identification and authentication

Identification and authentication has to be consistent for the user, irrespective of the underlying implementation and system. Identification and authentication for electronic health-services will be implemented using the centralized VETUMA-service which is already in production. (43) (44)

VETUMA is a service for identification, authentication and making payments on the net using the electronic business applications of government organisations. The service is provided by the ministry of finance and it is run by Fujitsu Services Ltd. Applications for electronic business can use VETUMA identification and authentication using its call interface. Vetuma offers three different methods for the citizen to identify himself:
- Identification and authentication based on the Citizen Certificate which can reside on a smart card or on a SIM-card of a mobile phone. The personal id can be retrieved from the Population Information system (VTJ)
- Identification and authentication based on user id and password:
  - Identification and authorisation using a web browser
  - Identification and authorisation using a mobile phone
- Identification and authentication service in the internet offered by the banks (Tupas)
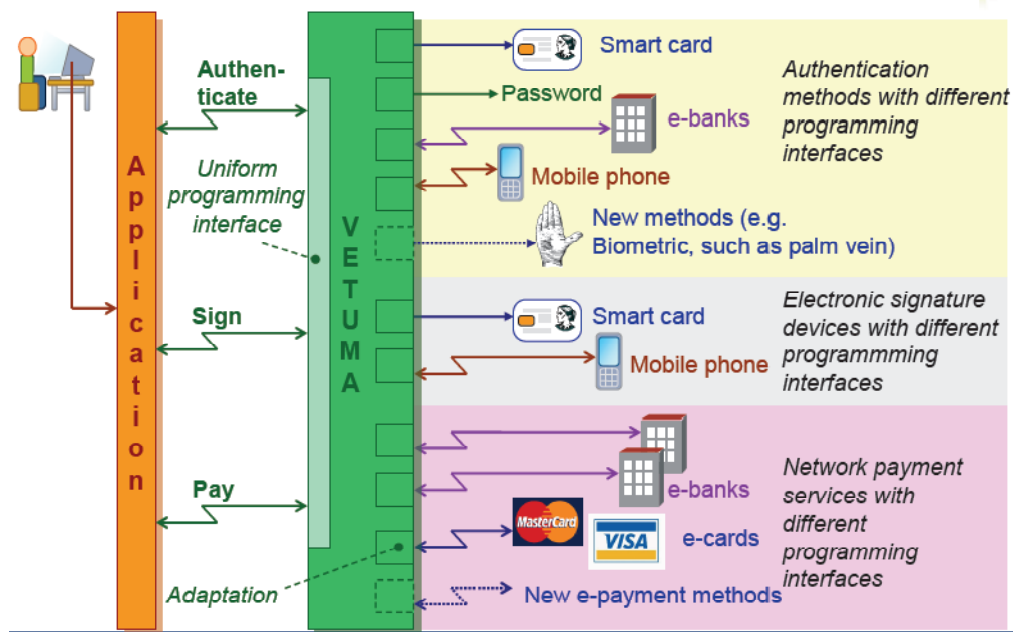
Picture 17 Set-up of the VETUMA service (43)

Vetuma –service sets certain requirements for the web browser:
- Support for http-protocol versions 1.0 or 1.1
- Accept session cookies
- Accept execution of JavaScripts (recommendation)
- Support for SSL version 3.0 or TLS version 1.0 and minimum 128-bit encryption

The feasibility of the Tunnistus.fi service should also be studied. Tunnistus.fi is a shared electronic service provided by The Social Insurance Institution of Finland (Kela), the Ministry of Employment and the Economy and The Tax Administration. The service delivers trusted identification and authentication of the user. 'Tunnistus.fi' -service passes credentials over the internet using an encrypted connection. The requirements are an identity card with a chip and a smart card reader or personal or company net banking credentials.

An extended VTJ (Population Information System)-query, which would enable checking the residency of a citizen, will be implemented soon. More information of the development plans can be found at
http://www.vaestorekisterikeskus.fi/vrk/home.nsf/www/populationinformationsystem.

The solution for identification and authentication is designed to include VETUMA-services at least.

7   ARCHITECTURE

This chapter describes the crucial elements of architecture. It is a high level illustration and will need to be specified in detail. The objective is to give guidelines to enable the building of a coherent and aligned architecture for electronic service modules.

Standardized solutions save costs in design, building and implementation of systems and increase the effectiveness of their management and maintenance. The users benefit from standardized solutions through better interoperability and uniform user interfaces.

Saini architecture sets a common goal for design and coordinates the work of everyone involved in planning the interoperable network of healthcare systems. The architecture enables better utilization of customer/patient data in the various healthcare processes.

Finland has made heavy investments in the systems to support the work of healthcare professionals. The result is that almost 100 per cent of patient data is in electronic format in the systems of hospitals and healthcare centres. SAINI architecture has a different emphasis: the main user of the services is the citizen who needs to take greater responsibility for looking after his own health.

SAINI architecture needs to be implemented on a national level and it covers both the public and the private healthcare services sector. The third sector can and should also follow the architecture guidelines when developing their electronic services. The architectural work is based on best practice and the results of numerous e-business projects over the last years and practical experience of existing electronic healthcare services.

The target architecture is based on the process and services descriptions created in the planning of activities. The technical guidelines rely on standards and well-supported information technology.

SOA-based reusable services, standardized interfaces and information constructs (e.g. Personal Health Record) reduce overlapping efforts and enable the building of interoperable systems. Reusability and common, shared services also mean clarity to citizens who today use heterogeneous systems.

Building high-quality and rich services requires an integrated network of services. This means interoperability with and between healthcare service providers´ operational systems and databases. The national Electronic Health Record Archive Services will be the most crucial system supporting networked services, but flexibility calls for being prepared to integrate into other operational systems as well.

7.1 Service Oriented Architecture

SAINI services are based on Service Oriented Architecture (SOA). It means expressing the functionality of information systems as services and reusing these services when building new systems. SOA is the prevailing architecture model and practically all major vendors support SOA.

Picture 18 describes the logical components and their relationships in SOA.
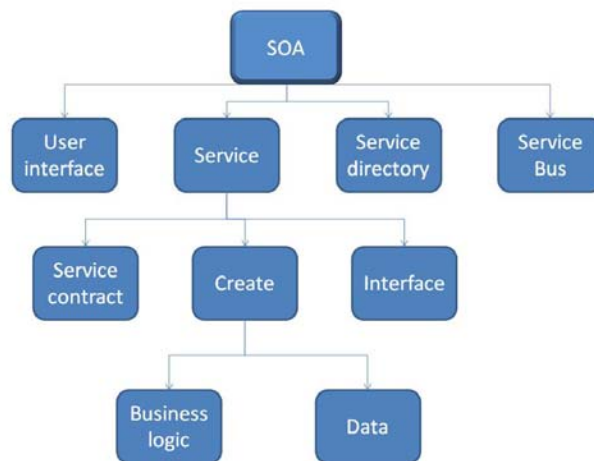
Picture 18 Components of Service Oriented Architecture (45)

The main components in SOA are
- User Interface
- Service
- Service Directory
- Service Bus

The end-user utilizes the services via the user interface. The service directory is used to locate the services. The services are registered in the service registry.

On a logical level SOA always contains an Enterprise Service Bus (ESB). ESB is used to integrate different services and parties. ESB enables integration of heterogeneous technologies and platforms. It enables different integration logics. In addition it often provides technical infrastructure services such as logging, security, transformations and transaction management.

A service consists of the following components:
- Contract
- Interface
- Code
- Business Logic
- Data

Each service description contains the five items mentioned above.

A service directory is needed in the specification and design phase. It contains information about published services, their interfaces, contracts and functions. The service directory can be implemented separately or as an extension to the service registry. There is a need to set up a national directory of services which will enable the utilization of shared services.

The services are classified into four different layers in the service architecture.
1. Infrastructure services
2. Basic services
3. Composed services
4. Process services

The infrastructure services are the simplest. The abstraction level of the services increases with the classification hierarchy. Each class in the hierarchy sets out specific requirements and principles that the services of that class have to follow. Another principle is that the lower level services may not be dependent on the services of higher level, e.g. infrastructure services on process services.

SAINI architecture supports the interoperability of services in three categories:
*   Centralized and shared services for healthcare service providers and citizens (one centralized system)
*   Distributed services that healthcare service providers can create and run by themselves
*   Development of standards to make applications on the markets SAINI compliant.

All three courses of action are applied in parallel depending on whichever is best suited to each service. The management model of the architecture is based on controlled and coordinated distribution.

A Software-as-a-Service (SaaS) model in delivering the systems is well suited to Service Oriented Architectures. In this model the software vendor offers the solution as a service over the internet.

7.2 Overall architecture

overall architecture is based on controlled and coordinated, but distributed architecture; a kind of hybrid model. It contains features of both a completely centralized and an extensively distributed model. Controlled and coordinated distribution of SAINI network services are created on both organisational and national levels. The goal is to take the best features of both models. The architecture follows the recommendations and guidelines set out by governmental authorities.

The architecture contains a SAINI network portal, but encourages the setting up of a limited number of sector-oriented portals for the network services. A sector can mean an organisation set up by several municipalities, a healthcare district, an occupational health service provider with national coverage, a group of dental clinics, a national third sector service provider, a cluster of a certain healthcare service users or a cluster of private healthcare providers. A 'sector' is located between primary organisations and the national level. Picture 19 shows which services we propose be centralized (national level) and which distributed on either a regional / sector or organisational level.
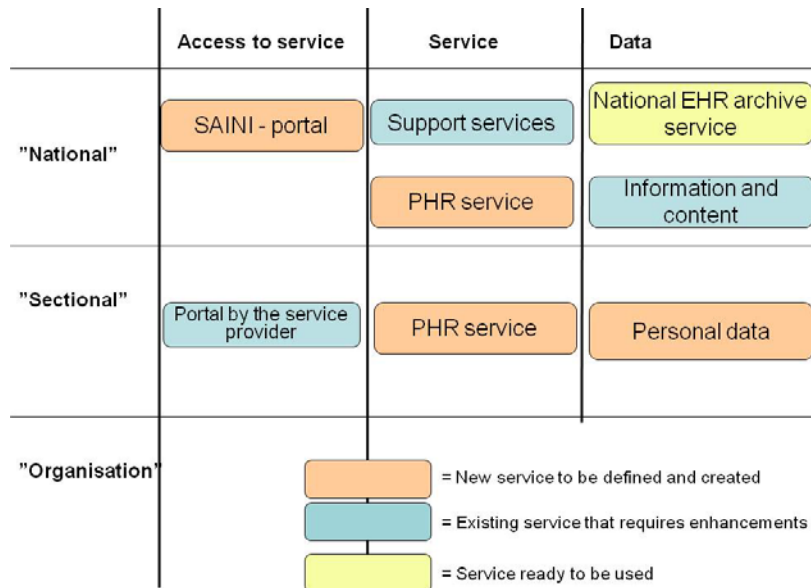
Picture 19 The principle of a controlled distribution of architecture

In this model an important role is played by the national Electronic Health Record Archive service, although in principle it is but one background system among other background systems.

In this model the common and shared functionalities of the Personal Health Record Services are provided centrally, but in addition to the core set of services, organisations on the sectional / regional level can provide their own differentiating services customized to suit the special needs of the region / sector. The citizens have the possibility to use one service, which is centrally provided with regional / sectional value adding services, when available.

Overall architecture consists of a portal providing access and a user interface to various service channels, the actual platform and operating (legacy) systems. Picture 20 represents the overall architecture on a general level.
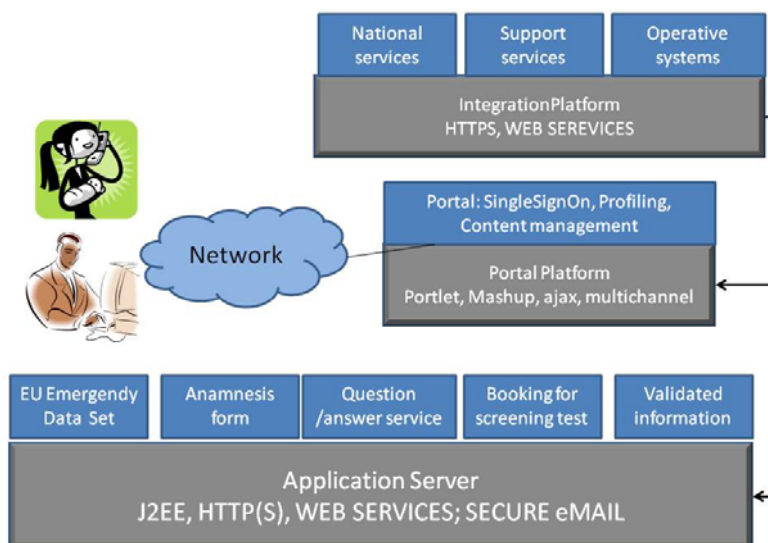
Picture 20 Overall architecture

The portal is not just one national centralized service point. Services based on the architecture can be integrated to other portals as a package or by selecting only some of the services.

The citizen can access and use all services through the internet via a web browser. Certain services can also be used through SMS messages, e.g. booking information, short messages and notifications. A web browser is the primary channel for services. Multiple channels for a service are always supported when it adds value for users.

7.3 Technical Solutions

Service-oriented architectures are often implemented with web services –technology, which is the proposed primary solution for SAINI services. The user interface for -services has to adapt to very different users, which leads to the use of new versatile www user interface technologies. SAINI services are implemented using Rich Internet Application (RIA) solutions which take advantage of technologies such as AJAX and Mashup. Web Services can be too heavy a solution for simple services and then Portlet or Mashup technology is used. The recommendation is to use WS-I Basic Profile 1.1 standards.

The Web Services Interoperability Organisation (WS-I) is an industry consortium chartered to promote interoperability amongst the stack of web services specifications on different platforms. It consists of the major vendors such as Microsoft, BEA, IBM, Oracle, SAP and Nokia. The WS-I standard significantly improves interoperability between different vendors' technical platforms.

WS-I Basic Profile 1.1 sets standards on
- Messaging
- Service interface descriptions

Security is a critical part of the services. WS-I standard is not yet comprehensive regarding security, but it is the best of the available solutions and different vendors are committed to investing in developing it further. Services utilizing Mashup-technologies contain more security risks because the technologies are new and part of their functionality resides in the workstation. Due to the criticality of security issues (especially confidentiality and data integrity) selecting a more traditional technology is also recommended. The recommendation is to use WS-I Basic Security Profile 1.0 standard for technical security standards.

The implementation technology of the services (like a programming language) is not significant in SAINI architecture. By conforming to SAINI interface definitions and to the overall principles, the services can be built to be interoperable and reusable. However, when selecting the implementation technology for the services, the lifecycle of the technology has to be assessed as well as whether the technology meets the standards recommended in this document.

For purely informative services which are used to exchange non-personal data RSS technology can be used. Ii is recommended that implementation of the services be based on Web Services -level services.

In implementing the portal a wide selection of basic functions is needed: personalization, content management, session management, user management etc. The most effective way to implement these types of functionality is to utilize special portal platforms. Advanced Open Source platforms can also be utilized.

The SAINI services and integration services are implemented using an application server solution. Interfaces are needed to public operative systems, public databases and support services.

7.4 Information architecture

The new concept of Personal Health Record services calls for updated information architecture.

Information in the SAINI service concept is divided into four main categories:

	Context-free	Contextual
"General"	General, official, educational, Informative data related to Healthcare matters	Information about health-related matters in context. Context being area, service, care, illness, treatment, medication, etc.
"Personal"	**Created and owned by the healthcare professional** Personal health information covering all data created by service providers.	**Created and owned by the citizen** Personal health information created by the citizen and/or in the home care / self care settings related to certain care.

Picture 21 Classification of information in SAINI services

1) General, official and educational information about healthcare services, illnesses and their treatment and care as well as health promotion. This is validated information
2) Personal information related to specific illnesses and their treatment and care, promotion of health etc.

The first category 'General information' contains articles, recommendations, guides, research papers etc. It can further be divided into two sub-categories: Context-free and contextual. Contextual information represents subsets of the general information with more specific details depending on the type of information and the context; for example information about services in a specified region or area of expertise, information about specific illness covering all aspects of that illness, information about an epidemic in a certain area.

General information related to healthcare is targeted at all users. The citizen can search for specific information with easy-to-use tools to help him understand healthcare related matters. General information can also be 'pushed' to the user's interface. Contextual information is tailored to various target groups and segments. Segmentation can be based on various criteria; phase in life, chronic illness or where the person lives for example. The user can personalize the interface and select what kind of information they want to receive.

Personal information is strictly confidential and managed with highly secure applications. Personal information is further divided into two classes:

- Legal and official electronic health records created by the professional staff of healthcare service providers. Includes information about one's medication and appointments and care.
- Information about one's self-care or other actions to promote one's own health created by the citizen himself. Includes self-care notes and measurements.

Personal healthcare data has traditionally been on paper, but there are now applications to support the keeping of personal health records. Information in a personal health record is both subjective and objective. Objective information is generated by home diagnosis devices. Subjective information is created by the citizen, when he types remarks and observations about the progress of self-care actions and / or effects of medication.

The Interchange of Data between Administrations (IDA) programme has published the European Interoperability Framework (EIF), which provides a way to structure information in applications and systems. EIF gives guidelines for interoperability between e-government and electronic services among the EU countries. Interoperability is required on three levels: 1.) Technical, 2.) Semantic and 3.) Organisational

The Ministry of Social Affairs and Health, National Public Health Institute, National Research and Development Centre for Welfare and Health and the HL 7 –association have a leading role in defining healthcare information architecture. The development of the National Electronic Health Record Archive has produced some parts of the information architecture, namely the structure of the core data set in the electronic health record.
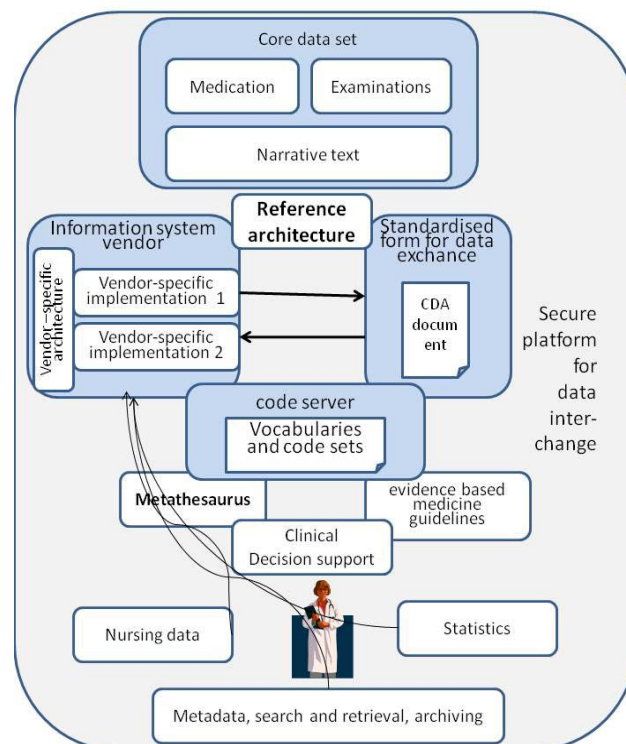
Picture 22 Elements of healthcare information architecture

HL 7 has promoted the use of information standards, and the creation of the National Electronic Health Record Archive speeds up the implementation of standards. Originally

each operational system had its own information structures, which now need to be revised according to specifications based on HL 7.

7.5 Integration architecture

SAINI integration architecture is based on open standardized interfaces. The services are mainly created using Web Services and can be used by healthcare providers as specified in the service contracts. Technical implementation, production and the governance model of the services have to be standardised.

The SAINI integration architecture does not initially require a special integration platform. The integration features of the application server are enough in the first phase. When the number of services and users increases, an Enterprise Service Bus (ESB) platform or an integration platform offering a better service level, need to be implemented. Almost all healthcare districts and major units use different platforms and these can naturally be utilized in SAINI architecture.

The integration with the National Electronic Health Record Services will be implemented using a national messaging service. Along the specifications of the National EHR, the integration will use Web Services/SOAP interfaces enabling flexible connections to client systems. The service enabling citizens view their own record in the archive could be interfaced technically to SAINI services.
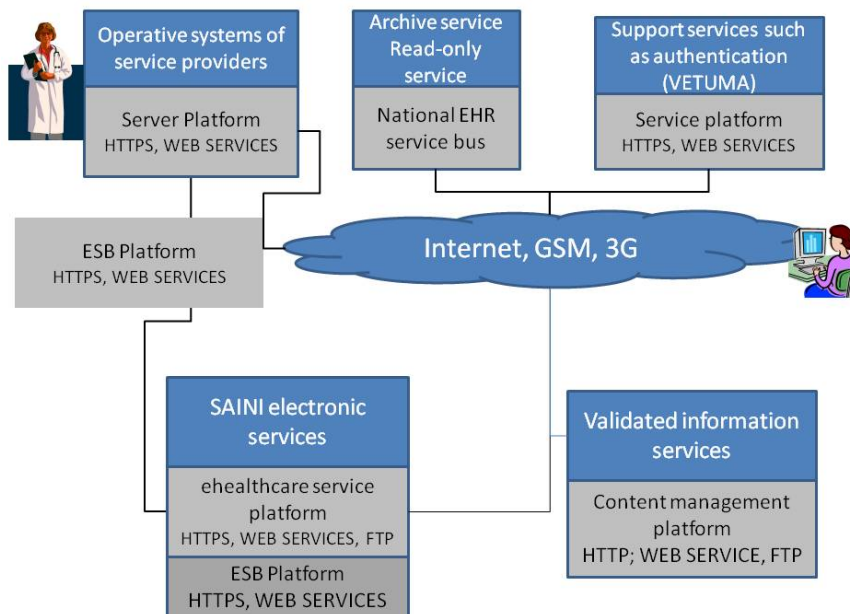
Picture 23 Integration architecture (ESB-platform optional)

In addition to Web Services technology, other technologies (FTP, RSS, JMS etc.) will be reviewed in the more detailed design of the integration architecture.

Specification of the interfaces as well as implementation techniques should be done at the initial phase of the technical design. The interfaces of the services of the patient administration and clinical applications are to be specified in collaboration with the HL7 association.

7.6 Security

Particular attention has to be paid to security, privacy and confidentiality solutions. The SAINI security framework consists of the following services:
1. Digital signature
2. Encryption
3. Identification and authentication
4. Identity management
5. Authorisation and access control
6. Auditing and logging

An advanced digital signature enables digitalization of processes which demand a legally valid personal signature. The digital signature proves the originality and integrity of the data. Handling of legal patient documents follows the practices set out for the national EHR archive. In the handling of other documents, the digital signature of the application is used.

At this moment there are no practical solutions for the digital signatures of citizens. When the services for digital signatures are available, operational and broadly used, they will be introduced in SAINI. In autumn 2008 it will be possible for citizens to have their certificates on the SIM-cards of their mobile phones. Mobile phone certificates support strong authentication which is required in matters related to healthcare.

Data encryption is a method of protecting data from non-authorized users. The Personal Data Act requires the encryption of sensitive data when transferred in a network. The encryption has to be implemented in a distributed fashion according to the needs of the service in question. In data transmission encryption methods have to be used. The technical capacity of the encryption has to be high enough not to cause problems with response times.

Identification and authentication are crucial support services and they must be in place in the first stages of SAINI services. Reliable identification of the user enables access control and auditing of the user's activities. Authentication ensures that identification is correct.

Identity management is to be implemented as part of the user management solution. Access control restricts the use of the services based on the rights granted in the identity management. The auditing service checks usage afterwards. Auditing is implemented using logging services, for example, and it is complementary to other security measures.

The identity management needed in SAINI services is implemented centrally and is role-based. The user himself is responsible for access management to his own personal health record services. The user can grant access rights to his own PHR. Access can be specified at the individual data item level. Identity management uses a structured language (XACML).

In a centralized authentication solution the user signs on to different services through a shared system. The identification methods are based on PKI methods which support implementation of digital signatures. The Citizen Certificate is the recommended method for identification, but its coverage is not wide enough to make it the only choice. The banks' Tupas method has wide coverage and is secure enough as an identification method, but it does not support advanced digital signatures.

The so called single-sign-on (SSO) can be implemented as part of a centralized identification solution or using a federation network. The need for a single-sign-on solution

is called for in situations where a single user has a need to sign on to multiple services. In order to be reliable a single-sign-on solution requires that the computers and user names are not shared and that the session management of the single-sign-on systems supports shared use.

The solution is a federation network, which can be used to implement distributed identification and authentication, identity management and access control. The technical standard of a federation network is SAML (Security Assertion Markup Language) which is useful also in centralized solutions.

The identifier of a person is a crucial requirement in the integration between identification, authentication, identity management and auditing. An unconditional requirement is that each user identified by the system has a unique identifier and that the identification methods identify the user in a similar way with this specific identifier. A good identifier is the personal ID. When the electronic identifier (FINEID) gains wider acceptance, it will be implemented. At present there are too few citizens who have electronic identifiers.

The usability requirement is that all security services are consistent and easy to use.

Logging is used in reporting and in technical control of the systems such as solving erroneous situations. Checking serves two main purposes:
- The customer sees who has used his personal data
- The security administrator checks the overall usage of data

Checking is implemented for each service that is based on a distributed principle.

The risk factors of internet based services and their impact have to be carefully considered in the implementation of SAINI services. For example denial-of-service attacks may prevent the use of the service. Also protection from a denial-of-service attack by limiting the traffic can limit the clients' use of the service.

The basic requirements for official personal data are:
- A strong identification and authentication of the user
- Integrity of the data
- Security and access control
- Non-repudiation
- Accessibility and availability
- Accountability

These requirements also have to be considered regarding data entered by the user himself, when they are transferred between services. Inside the services, strong identification of the user and the integrity of the data are critical requirements.

8 GOVERNANCE AND QUALITY ASSURANCE OF THE ARCHITECTURE

SAINI architecture is based on the principle of federation and calls for sophisticated governance. In practice this means that there is an appointed party who is responsible for the governance of the architecture. The architecture of electronic business within healthcare on the national level is extensive and complex and a strong authority is needed to control and guide it. Picture 37 shows the overall structure of the architecture.
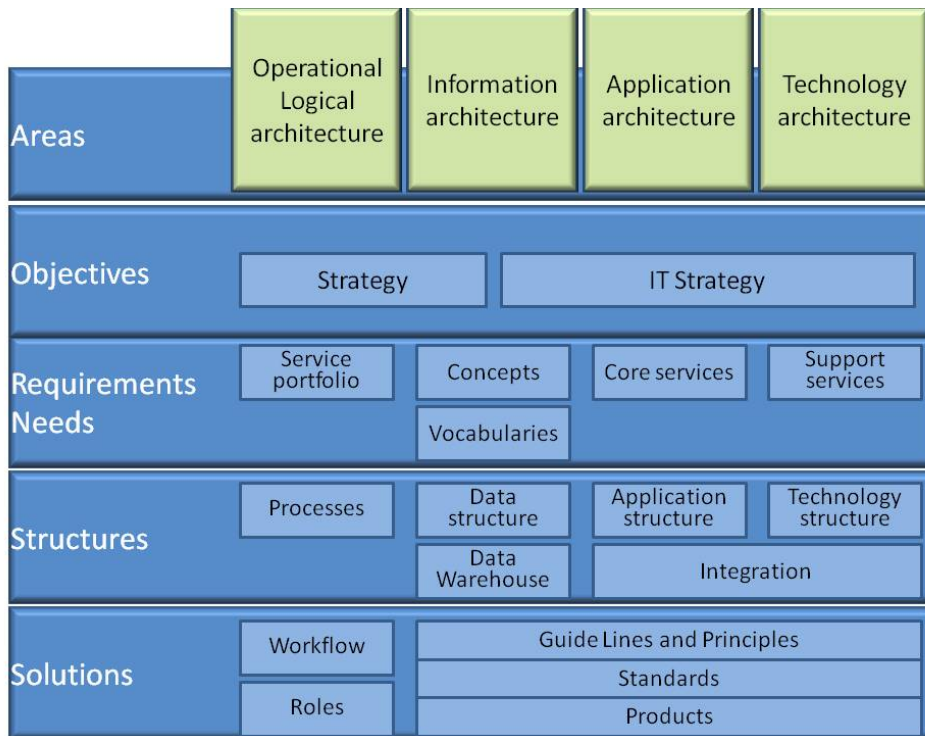
Picture 24 Structure of the architecture

The Advisory Board for Electronic Data Processing within Social Care and Health founded by the Ministry of Social Care and Health would be a natural choice for the actor responsible for the governance and development of the SAINI architecture. The board has the task "to promote the implementation and development of the national information systems and the harmonization and development of the systems of those services".

As an alternative solution a study could be carried out to establish whether a new collaborative body should be set up to coordinate the design and implementation of the SAINI architecture.

The responsible body uses the framework recently published by State IT management unit Management Unit for the governance work. The following is a brief description of the method version 1.0 related to SAINI architecture (46).

The Enterprise Architecture Framework is designed to support planning of governmental organisations' architectures on a national level. The framework is modular, which enables individual domains to be focussed on one at a time and does not necessitate an exhaustive

planning project. The framework has to be adjusted for each occasion by content and the level of precision. The framework is suitable for SAINI architecture without any major modifications.

The Enterprise Architecture Framework of State IT management unit has connections to other processes in the organisation. Governance is an ongoing process. It recognizes initiatives, follows up and implements areas of development and assures their compatibility with the Enterprise Architecture. The governance process initiates the planning of the enterprise architecture and is responsible for the implementation of the deliverables of the architecture work. Each development project has to interact with the governance process of the enterprise architecture to solve possible contradictions.

The framework for State IT management unit has three levels of detail and four architectural views. The levels are
- Government / National (SAINI: National level)
- Cluster / Domain (SAINI: sector, public, private, third sector)
- Office / Sub-Domain (SAINI: organisation, local)

The framework has four commonly known views:
1. Business and processes (e.g customer, organisation, stake holders, services and processes)
2. Information (e.g. strategic information assets, vocabularies, terminologies)
3. Applications (e.g. Applications portfolio, lifecycle of the applications)
4. Technologies (e.g. strategic choices for technology and standards, reference architectures)

There are three levels of decision-making in the framework. The highest level is the governmental level and it covers issues owned by and decided by government. This level takes into account the requirements set out by the EIF. The domain level consists of the governmental entities with independent authority to take decisions related to ICT. Initially these are the ministries but also cross-sectional processes, when they have a process owner with decision taking capacity on the above mentioned four views of enterprise architecture. Sub-domains are entities subordinate to domains, but with independent authority to take decisions related to ICT (e.g. companies, associations, healthcare districts, university hospitals).

Security and integration views apply to the whole framework and are connected to all other views. Security and integration have their own content in the framework.

The enterprise architecture development is coordinated by an organisation, which reports to the State IT management unit. The development processes are defined in the domains, domain architectures and ministries and development is carried out according to those processes. Most ministries use a continuous development model. The Advisory Board for the Electronic Data Processing within Social Care and Health is eventually going to utilize the enterprise architecture framework of State IT management unit.

9 IMPLEMENTATION AND LEADING CHANGE

The EU programme "eHealth Impact" (19) surveyed success factors in the various pilots in the EU and they can be summarised.

1) Creation of electronic health services must be carried out in close operation with all user groups: professional service providers and citizens as well as the paying parties.
2) A national strategy is necessary to coordinate and orchestrate development initiatives and programmes. There need to be clear short and long term objectives.
3) A holistic measurement and follow-up of costs and benefits is needed to avoid optimizing some areas leading to bottlenecks in others.
4) Identification of organisational and operational changes required.
5) Strong change leadership.
6) Long-term commitment and patience. Development requires changes in organisational and operational cultures, which takes some years.

These identified success factors should also be borne in mind when planning the various development projects.

The target is to empower the citizen. It is assumed that an empowered citizen will take a more active role and responsibility for his own health. However, it is important to realise and understand that not all citizens want to be empowered and take more responsibility. Finns are used to being taken care of and it can be frightening and intimidating for some to take on a new role. A lot of interactive communication and education is required to help citizens accept their new role and start using the new services.

The healthcare professionals are an important user group. The success of the services depends on how the professionals choose to make use of the tools. A great challenge is that the professionals have had to deal with systems that are not ideal for the purpose. The heritage of old operative systems might cast a shadow on the new tools.

The implementation of the electronic health services needs to be carefully phased and planned. In the Czech Republic the services were first introduced to clinicians, who introduced the services to their patients.

The surveys conducted in the U.S.A. have resulted in the following conclusions (47):

- The role of the doctor is crucial when 'selling' the services to citizens.
- It is important to get the doctors' "buy-in" as early as possible.
- The doctors will not accept the new services if they will not benefit from them. It is not enough that citizens and patients benefit from the services.
- The doctors will not start using the services if they are not integrated with what they do anyway.

It is clear that the electronic services will not bring any benefits if users do not use them. In order to meet the targets set and to get the benefits being looked for it is important to start education and interactive communication as early as possible. Soliciting feedback from users is a prerequisite for successful implementation.

The development of electronic health services needs to be done while staying aware of risks rooted in following:

- No identified and strong ownership and financing as well as clear leadership. This risk is closely tied to the way healthcare is organised in Finland. The structures of the Finnish healthcare system contribute to decentralized decision-making. Shortcomings have been noted in cooperation between healthcare service providers.
- Local IT solutions. The statutory requirement for local authorities to provide healthcare services has led to overlapping IT investments and to difficulties in integrating local IT solutions. In addition, in these proprietary information systems patient records do not currently exist in a structural format (in other words, they are stored in company-specific relational databases) and are thus not suitable for interoperability.
- Coordination of development projects and managing individual projects.
- Gaining nation-wide approval and commitment to the concepts and specifications of the service-modules.
- Adapting the operational models to benefit from the new services based on new technology. Giving up the old and out-dated ways.
- Support to various user groups throughout the phases of change.

One part of the implementation plan is the risk management plan. The risks are all manageable.
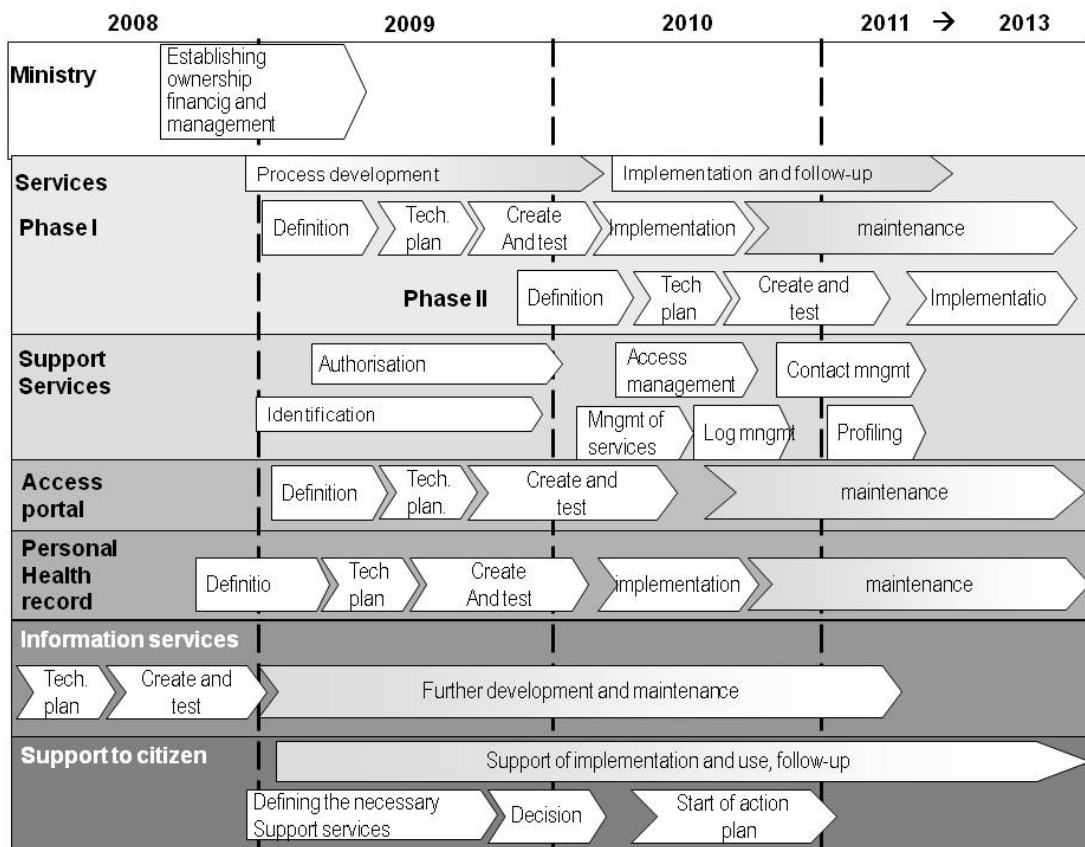
Picture 25 Implementation of the services

The Social Affairs and Health will draw up guide lines related to the ownership, financing and management of services. Once these crucial matters have been resolved the current ongoing development will become more structured.

The services to be offered in the first phase will be defined in more detail based on the experiences accumulated in the pilots. They will then be created according to the guide lines of the ministry created either centrally or by each organisation which wants to offer these services. The services in the first phase include booking of appointments, first version of PHR (anamnesis form and question – answer service) and EU Emergency Data Set. The support services required to launch the service are identification and registration.

Phase II will be defined in more detail once phase I has been implemented and feedback from the users collected. Further development of the services will be done in close interaction with the users.

10 APPENDIX 1: LOCAL GOVERNMENT IT MANAGEMENT UNIT KUNTAIT

Mission:
- By use of the means of ICT, to create nationally compatible customer-centric services for the use of the municipal community
- Support improvement of productivity of the municipalities and the success of structural and service reforms
- Coordinate a networked cooperation of municipalities, state government and other contributors

Projects 2008 – 2009

1. Information Management projects

TotIT – Business Intelligence for the leaders of Finish Municipalities
Developing solution for information management for the leaders of Finnish Municipalities. **Deliverable:** requirement specification for strategic information products for a Municipality's decision-making processes, a common taxonomy for Municipality Leaders' management information systems (terms, words, metadata) and open interfaces for the information systems.

Sote -Business Intelligence (Healthcare and Social Welfare)
Developing a solution for information management for the leaders of Municipalities' healthcare and social welfare sector. **Deliverable**: nation-wide performance and quality indicators and measurements for healthcare and social welfare services processes, Dictionary, Data models and OID codes for the Social Welfare sector.

2. Service Development projects

Customer Service Centre (ASPA) –project
Developing customer-centric service processes, multi-channel services and various service models (e.g. shared services) for citizens. Developing open and modular information systems, which support service centre model, including a concept of Customer Relationship Management (CRM).

Services for Family and youth –project
Developing electronic services for the support of interaction between home, day care and school and use of open and modular information systems,

Services for the Built Environment –project
Developing services and service models concerning construction, living-environment and support of relocation for the citizens, authorities and companies.

Recruitment and Substitute Portal (Human Resources) –project
Developing national-wide recruiting and substitute portal for the Finish Municipalities.

Electric Tendering System –project
Developing a shared Electronic Tendering System for the Finish Government and Finish Municipalities to support the processes of public procurement.

3. Electronic Archive

Electronic Archive Planning for Finnish Municipalities -project:
Finnish National Archives project for modelling Finnish municipalities' Processes and developing metadata structures (terms, data models etc.) for automated Archiving of documents.

4. Open interfaces

Geo-information interface -project
Developing common interface services for the Municipalities Geospatial-information. **Deliverable:** Common terms, data models, schema and interface services for the Geospatial information produced by the Finnish Municipalities.

5. Identity and Access Management

Virtu(K) – electronicID solutions
Developing common electronicID (eID) solutions for Municipalities and business models required for governing the solution.

Virtu(K) – Identity and Access Management
Developing common processes and solutions for improved employee identity and access management in the (Finnish) Municipalities. **Deliverable:** Identity Management Education Programmes, common solutions and services for improving Identity Management.

6. IT –Governance –projects

IT –governance
Developing Municipalities IT-processes based on COBIT.

Master Data Management
Developing models and solution for the improving Municipalities Master Data Management.

Benchmarking
Developing Benchmarking models and processes for Finish Municipalities' IT Management.

7. Development of interoperability (architecture)
Projects:
- Service Oriented Architecture in Finnish Municipalities
- Technology standards and Best Practises how to implement them
- Enterprise Architecture Models for Finnish Municipalities
- SOA implementation –project
- Service portal implementation –project
- Common support services for the Municipalities' eServices

11 REFERENCE LIST

1. **Valkeakari Susanne (ed.), Forsström Jari, Kilpikivi Pauli, Kuosmanen Pekka, Pirttivaara Marja.** SAINI - Kansalaisten sähköiset terveydenhuollon palvelut. [Online] 2008. [Cited: 10 June 2008.] http://www.sitra.fi/julkaisut/muut/SAINI_Loppuraportti.pdf?download=Lataa+pdf.

2. SAINI interim report. [Online] December 2007. [Cited: 10 June 2008.] http://www.sitra.fi/fi/Ohjelmat/terveydenhuolto/teho_hankkeet/Sahkoinen_asiointi/Sahkoinen_asiointi.htm.

3. Government Programme. [Online] 19 April 2007. [Cited: 10 June 2008.] http://www.valtioneuvosto.fi/hallitus/hallitusohjelma/pdf/en.pdf.

4. Valtioneuvoston periaatepäätös kansallisen tietoyhteiskuntapolitiikan tavoitteista vuosina 2007-2011. [Online] 6 June 2007. [Cited: 10 June 2008.] http://www.arjentietoyhteiskunta.fi/files/35/Valtioneuvoston_periaatepaatos.pdf.

5. Information Society Programme Finland pages. [Online] www.tietoyhteiskuntaohjelma.fi.

6. The Government gave new impetus to Finland's information society development. *press release.* [Online] 2007. [Cited:] http://www.valtioneuvosto.fi/ajankohtaista/tiedotteet/tiedote/en.jsp?oid=181938.

7. **Ministry of Transport and Communications;.** Ubiquitous Information Society, Action Programme 2008-2011. [Online] 2008. http://www.arjentietoyhteiskunta.fi/inenglish.

8. Sosiaali- ja terveysalan tiedonhallinta. *Information management in social and healthcare pages.* [Online] http://www.stm.fi/Resource.phx/vastt/tietoh/index.htx.

9. Laki sosiaali- ja terveydenhuollon asiakastietojen sähköisestä käsittelystä, 159/2007. *Law on electronic processing of customer information in social and health carte services.* [Online] www.finlex.fi/fi/laki/ajantasa/2007/20070159.

10. Laki sähköisestä lääkemääräyksestä 61/2007. *Law on ePrescription.* [Online] http://www.finlex.fi/fi/laki/ajantasa/2007/20070061.

11. Government Resolution on the Health 2015 Public health Programme. [Online] 2002. http://pre20031103.stm.fi/english/eho/publicat/ehocontents17.htm.

12. IT Strategy for the Administrative Sector of the Ministry of Social Affairs and Health 2007 – 2011. [Online] 2007. http://www.stm.fi/Resource.phx/publishing/documents/13163/index.htx.

13. **Alkula, Riitta.** Potilastiedot hallintaan kansallisilla eArkisto- ja eResepti-ratkaisuilla. *Electronic health records, eArchive and ePresciption, presentation.* [Online] 7 November 2007.

14. Kela toteuttaa terveydenhuollon sähköisen arkiston (Press release in Finnish). [Online] Kela, the Social Insurance Institution of Finland, 2 July 2007. [Cited: 10 June 2008.]

15. Kunta- ja palvelurakenneuudistus PARAS. *Municipality and servcise structure reform.* [Online] http://www.vm.fi/vm/fi/05_hankkeet/025_paras/index.jsp.

16. **Lopez, Ken.** Global Perspective on PHRs: Consumer Engagement in Health Information Exchange in Europe & the U.S. (presentation). [Online] 2007. [Cited: 10 June 2008.] www.nocalhimss.org/events/presentations/ICW-Presentation.ppt.

17. **Niska, Anne.** Presentation at Linjanvetoa Seminar. [Online] 28 November 2007. [Cited: 10 June 2008.] http://www.linjanvetoa.fi/files/orig/21_Niska_28112007.pdf.

18. **Stroetmann, Karl A; Jones, Tom; Dobrev, Alexander; Stroetmann, Veli N.** eHealth is Worth it. The economic benefits of implemented eHealth solutions at ten European sites. [Online] 2006. [Cited: 10 June 2008.] www.ehealth-impact.org/download/documents/ehealthimpactsept2006.pdf.

19. Final summary project report, eHealth IMPACT. [Online] 2006. [Cited: 10 June 2008.] http://www.ehealth-impact.org/download/documents/D6_2_Final_Report_ext.pdf.

20. **Huttunen, Nora.** Minkälaisia odotuksia ja tarpeita kohdistuu eHealth --palveluihin Suomen julkisessa perusterveydenhuollossa lääkäreiden näkökulmasta? (presentation). [Online] 7 May 2007. [Cited: 10 June 2008.] http://www.bit.hut.fi/hema/docs/seminaari/2007-05-07_Huttunen.pdf.

21. IZIP, Czech Republic – web based electronic health record , Project story. [Online] 2006. http://ec.europa.eu/information_society/activities/health/docs/events/opendays2006/ehealth-impact-7-5.pdf .

22. Connecting for Health A public private collaborative. [Online] 2003. http://www.connectingforhealth.org/resources/final_phwg_report1.pdf.

23. eHealth Roadmap – Finland. *Reports of the Ministry of Social Affairs and Health 2007:15.* [Online] 2007. http://www.stm.fi/Resource.phx/publishing/documents/10546/index.htx.

24. National Electronic Patient Record Archive Kanta (in Finnish). [Online] Ministry of Social Affairs and Health Care. [Cited: 10 June 2008.] http://www.stm.fi/Resource.phx/vastt/tietoh/arkisto.htx.

25. KuntaIT Municipality IT. [Online] http://www.kuntait.fi; http://wiki.kuntait.fi .

26. ValtIT (Government-IT). [Online] [Cited: 10 June 2008.] http://www.valtit.fi .

27. **Nivala, Mira.** ValtIT - Asiakaslähtöiset sähköiset palvelut kehittämisohjelma. Asiointitilin ja tavoitettavuustiedon kehittämistyö. *eGovernment presentation, in Finnish.* [Online] Ministry of Finance, 22 October 2007. http://www.vm.fi/vm/fi/04_julkaisut_ja_asiakirjat/03_muut_asiakirjat/20071016ValtIT/04_SA_Asiointitilin_ja_tavoitettavuustiedon_kehittaeminen_22_10_2007_%5BVain_luku%5D.pdf.

28. Ubiquitous Information Society (Arjen tietoyhteiskunta). [Online] http://www.arjentietoyhteiskunta.fi/inenglish.

29. **Maanavilja, Aimo;.** Muutoksen tahdit. *Beat of Change, comment speech.* [Online] Tekes workshop, 25 September 2007.

30. **Pietilä, Simo.** HUS sähköinen asiointi – tilannekatsaus . *HUS Hospital district of Helsinki and Uusimaa: state of art of eServices.* [Online] 18 December 2006.

31. **HL7.** EHR and PHR standardization work. [Online] [Cited: 10 June 2008.] http://www.hl7.org/Library/Committees/ehr/EHR_PHRSFM_R1_D1_2007NOV%20files.zip .

32. **City of Lahti.** online appointment scheduling services for dentistry. [Online] [Cited: 10 June 2008.] http://www.lahtihammas.fi/quickcontacts/.

33. Wellcom project. [Online] City of Turku. [Cited: 10 June 2008.] http://www.turku.fi/public/default.aspx?contentid=28913&nodeid=6820.

34. Online appointment scheduling service. [Online] City of Turku. [Cited: 10 June 2008.] http://www.turku.fi/Public/default.aspx?contentid=5786.

35. online appointment scheduling services for laboratories. [Online] City of Turku. [Cited: 10 June 2008.] https://tykslab.ajanvaraus.vsshp.fi.

36. Online appointment scheduling service for dentistry. [Online] Helsinki Health Centre. [Cited: 10 June 2008.]

37. Online appointment scheduling service. [Online] Dextra. [Cited: 10 June 2008.] https://webajanvaraus.dextra.fi.

38. online appointment scheduling service for dentistry. [Online] koskident. [Cited: 10 June 2008.]

39. **Ruuskanen, Veijo;.** Sähköinen asiointi ja aluetietojärjestelmät. *conference presentation.* [Online] Sairaalatekniikan päivät , Hospital technology conference, 7.-8. February 2006. http://www.ssty.fi/images/7_Veijo_Ruuskanen.pdf .

40. TerveSuomi.fi - Citizen´s health information portal. [Online] www.TerveSuomi.fi.

41. Terveyskirjasto. *Health library, in Finnish.* [Online] Duodecim. www.terveyskirjasto.fi.

42. Terveysportti. *Health portal for professionals, in Finnish.* [Online] Duodecim. wwww.terveysportti.fi.

43. VETUMA palvelu, sovelluksille tarjotun toiminnallisuuden kuvaus. *VETUMA services: electronic authentication and payment - functionality report, in Finnish .* [Online] Ministry of Finance, 25 February 2008.
http://www.suomi.fi/suomifi/laatuaverkkoon/asiointi_ja_lomakkeet/sahkoinen_asiointi/verk kotunnistaminen_ja_maksaminen/tekninen_rajapinta/vetuma_palvelun_sovelluksille_tarjoa man_toiminnallisuuden_kuvaus_v2.1/vetuma_palvelun_sovelluksille_tarjoaman_toiminna.
44. JHS 164 Tunnistautuminen ja maksaminen sähköisessä asioinnissa VETUMA-palvelun avulla. *Identification and payments in electronic services with VETUMA-service, report in Finnish.* [Online] Ministry of Finance, 2007. http://www.jhs-suositukset.fi//web/guest/jhs/recommendations?p_p_id=oh_metadata_list_WAR_ohmetada talist_INSTANCE_kynQ&p_p_action=0&p_p_state=normal&p_p_mode=view&p_p_col_id=c olumn-2&p_p_col_pos=1&p_p_col_count=2&recview=164_242&prevmode=normal.
45. **Krafzig, Dirk; Banke, Karl; Slama, Dirk.** *Enterprise SOA.* s.l. : Prentice Hall, 2005.
46. Valtiohallinnon arkkitehtuurin suunnittelu -hankkeen loppuraportti, Yhtenäinen malli toiminnan ja tietojärjestelmien kokonaisvaltaiseen suunnitteluun, Versio 1.10. *National eGovernment architecture, Final Report version 1.10 in Finnish.* [Online] Ministry of Finance, 2007.
http://www.vm.fi/vm/fi/04_julkaisut_ja_asiakirjat/03_muut_asiakirjat/20070628Kokona/02 _Loppuraportti__yhteenveto.pdf.
47. CEO Survival Guide™. Personal Health Records. 2007 Edition. [Online] 2007. [Cited: 10 June 2008.] http://www.qualityforum.org/pdf/reports/txceosummary.pdf.

12 ANNEX 1: TERMS IN ENGLISH AND FINNISH

Accessibility	Esteettömyys, saavutettavuus
Adjacent services	Liitännäispalvelut
Architecture model	Arkkitehtuurimalli
Authenticator	Tunnistaja; tunnistuspalvelu
Anonymous Use	Anonyymikäyttö
Biometric identification	Biotunnistus; Biotunnistaminen
Certificate	Varmenne
Certification	Varmentaminen
Certification authority	Varmentaja
Channel, multichannel	Kanava, Monikanavaisuus
Consent	Suostumus
Contact management	Tavoitettavuus; Sähköinen tavoitettavuus
Cookie	Eväste
Customer centric; customer focused	Asiakaskeskeisyys
Data protection	Tietosuoja
Data security	Tietoaineistoturvallisuus
Digital Signature	Digitaalinen allekirjoitus
Electronic case processing system; (Back-end-system)	Asiankäsittelyjärjestelmä; asianhallintajärjestelmä
Electronic transaction process	Asiointiprosessi
Electronic signature	Sähköinen allekirjoitus
Electronic transactions	Sähköinen asiointi
Electronic transaction services	Sähköinen asiointipalvelu
Electronic prescription	Sähköinen lääkemääräys
Electronic Health record (EHR)	Sähköinen potilaskertomus
(eGovernment) platform	Sähköisen asioinnin alusta
Electronic transaction services	Asiointipalvelu
Electronic transaction system; (Front-end	Asiointijärjestelmä

system)	
Identifier; identification data	Tunniste; tunnistetiedot
Identification	Tunnistus; tunnistaminen
Identify	Tunnistaa
Information security	Tietoturva; Tietoturvallisuus
Information services	Tietopalvelut
Integrity	Tietojen eheys; muuttumattomuus
Identity management; Digital identity management (IDM)	Identiteetinhallinta; Sähköisen identiteetin hallinta
Information management system	Asiankäsittelyjärjestelmä; asianhallintajärjestelmä
Interest group; stakeholder	Sidosryhmä
Interface	Rajapinta
Integrity	Eheys
Medication	Lääkitys
Medicine; pharmaceutical	Lääke; lääke-
Multi channel	Monikanavaisuus; Sähköisen asioinnin monikanavaisuus
National Code server	Koodistopalvelu
Patient Record	Potilasasiakirja
Personal Health Record (PHR); electronic Personal Health Record (ePHR)	Terveystaltio, terveystili, terveyskortti
Pharmaceutical supplier	Lääkkeen toimittaja
Pharmaceutical database	Lääketietokanta
Portal	Portaali
Prescriber	Lääkkeen määrääjä
Prescription archive	Reseptiarkisto
Prescription center	Reseptikeskus
Privacy	Yksityisyys
Register	Henkilörekisteri
Register description	Rekisteriseloste
Secrecy	Salassapito
Service	Palvelu
Service application	Palvelusovellus; sähköisen asioinnin palvelusovellus
Service event	Palvelutapahtuma
Service information	Palvelutieto
Signature	Allekirjoitus
Smart card;	Virkakortti

chip card	Älykortti
Strong Identification; Strong authentication	Vahva tunnistus; vahva tunnistaminen
Support Services	Tukipalvelut
Time stamp	Aikaleima
Token	Tunnistusväline
Usability	Käytettävyys
User	Käyttäjä
User experience	Käyttäjäkokemus
Weak identication; weak authentication	Kevyt tunnistus
Website	Verkkosivusto