

CREATING A NATIONAL E-HEALTH INFRASTRUCTURE: THE CHALLENGE OF THE INSTALLED BASE

Complete Research

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Abstract

In this paper we address the question of how the installed base influences the process of creating a national architecture for eHealth. National eHealth solutions empower patients to access information and services and enable more efficient and cost effective ways of delivering care. Based on a case study conducted over a two year period, we trace the design of services between citizens and their GPs in the context of the Norwegian eHealth portal. Our analysis is based on the concept of installed base from Information Infrastructure studies that allows us to focus on the relationship between needs, capabilities and the existing technical components. Specifically, we take a relational view on the installed base and analyse three core decisions shaping the architecture of the infrastructure. These decisions expose the work of creating an infrastructure in relation to how existing technologies are selected and configured and how new needs are identified. This paper contributes to the understanding of Information Infrastructure evolution by taking a sociotechnical view on the creation of IT architectures.

Keywords: eHealth, Information Infrastructure, Installed Base, Architecture.

1 Introduction

Many countries are in the process of implementing national eHealth services. These services are expected to enable more efficient and cost effective ways of delivering care, and to make healthcare more accessible to patients. However, recent study on eHealth in the European context found that the challenges involved in reaching national agreement about eHealth strategies, implementing them, and meeting the related management and organizational tasks have been vastly underestimated (Stroetmann, Artmann, & Stroetmann, 2011).

In this paper we investigate the process of creating a national architecture for eHealth. In this process core components are identified and linked together with the aim of supporting a variety of services on a national scale. We frame our study within research on the evolution of Information Infrastructures (II) (Aanestad & Jensen, 2011, p. 17; C. Ciborra, Braa, & Cordella, 2000; Hanseth & Lyytinen, 2010; Hanseth, Monteiro, & Hatling, 1996). This body of research argues that large scale and complex systems, defined as information infrastructures, are historically shaped and result from the “bringing together and adapting of pre-existing technical and institutional materials” (Lanzara, 2014, p. 17). Thus pre-existing arrangements influence the evolution of infrastructures. More specifically, II research argues that infrastructures are built on an *installed base* that restricts the scope of design and influences architectural decisions. Further, II research has recently discussed the centrality of architecture design in infrastructure evolution (Aanestad & Jensen, 2011; Aanestad, Sæbø, & Grünfeld, 2014; Grisot, Hanseth, & Thorseng, 2014).

Taking an II perspective, in this paper we study how the installed base influences the process of creating a national architecture for eHealth in the context of Norway. The background of the case is the

ongoing design and development of the Norwegian eHealth portal called Helsenorge.no. The portal was launched in June 2011, with the aim to provide secure digital services to citizens (Norwegian Ministry of Health and Care Services, 2012). While initially it mainly supported dissemination of information and access to a limited set of personal health information (e.g. vaccinations, prescriptions), at present several eHealth interactive services are being designed. The long-term vision is to develop a common platform for public healthcare digital services towards the citizens. Together with the launch of the portal a new organizational unit within the Directorate of Health was created with the mandate to further develop and maintain the portal on behalf of the sector. Recently a new eHealth strategy has strengthened the role of the portal (Norwegian Ministry of Health and Care Services, 2014).

In this paper we focus on one of the services – eDialogue - that are currently being designed in the context of the portal. We have selected this case because the eDialogue project is the first one designing novel eHealth services in the context of the national portal since its launch. This meant that the project was involved in decision making not only for the realization of the dialogue services, but also for architectural design impacting the shaping of the national eHealth portal. In our analysis we address three key architectural decisions. These decisions expose the work of creating an infrastructure in relation to how existing technologies are selected and configured and how new needs are identified. Our findings provide an understanding of the sociotechnical complexities involved in creating a national eHealth infrastructure.

The paper is structured as follows. The next section presents the theoretical background on installed base and Information Infrastructure studies to position our research. Then, we present the research methodology followed by the description of the empirical case. Next, we present our analysis and discuss our findings and contribution. The paper concludes by highlighting future research directions.

2 ‘Installed base’ and Information Infrastructure research

Information Infrastructure research deals with the dynamics of large-scale systems. An exemplary study in this stream of research is the study on how internet has grown into a global infrastructure (Hanseth & Lyytinen, 2010). Others have addressed the challenges faced by corporate infrastructures (C. Ciborra et al., 2000). IIs typically encompass a heterogeneous collection of different technologies, components, protocols, and applications to support different and varying application areas and use over time and across geographical distances (Rolland & Monteiro, 2002). Because of this complexity managing the gradual evolution of an II can be better understood as an act of cultivation than one of control (C. U. Ciborra, 1997).

A central concept to understand the evolution of II is that of *installed base* on which II are built. Hanseth and Lyytinen define an installed base as the existing “set of ICT capabilities and their users, operations and design communities” (Hanseth & Lyytinen, 2010, p. 4), but it also encompasses existing institutional and organizational components (Lanzara, 2014). With this term research on II has conceptualised the tension between the fact that IIs are not easily changed and at the same time they are constantly evolving (Hanseth et al., 1996), also called the tension between innovation and conservation (Lanzara, 2014). Thus an installed base is said to be both enabling and constraining infrastructure evolution (Hanseth et al., 1996). Lanzara describes this dual character by saying that an installed base “can be a resource for creative design and innovation or a trap from which it is difficult to escape” (Lanzara, 2014, p. 19). For instance, Hanseth and Aanestad discuss ‘bootstrapping’ as a strategy to trigger the growth of the installed base of users of networked technologies (Hanseth & Aanestad, 2003). In this case the installed base of users has enabled the growth of the infrastructure by attracting more and more users. Differently, other scholars discuss the irreversibility of the installed base for instance when standards grow and diffuse (Egyedi & Blind, 2008; Hanseth et al., 1996).

In this paper we take a *relational* view on the installed base in order to understand the reasons why certain architectural decisions are taken in the process of designing an infrastructure. A relational view is based on practice theory where sense making processes through which users and stakeholder appre-

ciate technology are emphasised. For instance, Star considers infrastructures relational because they mean different things to different people, that is, they acquire certain qualities only in relation to organized practices (Star, 1999). Similarly identifying the installed base is an empirical question dependent on the contingencies of each case and the sense making of the involved actors. Specifically in this paper we focus on the decisions taken to assemble components in the core architecture of a national infrastructure.

3 Research methodology

Our research is designed as a longitudinal case study to understand the dynamics of how information infrastructures evolve in the health care context. The purpose of the case study has been to investigate the tactics and approaches followed by the people engaged in putting the Norwegian national eHealth portal in place. We have studied how the project unfolds in relation to technologies, architecture, negotiations with stakeholders including the EPRs' vendors, and other interested parties (e.g. GP association). Fieldwork is conducted in the national eHealth portal unit, within the eHealth and IT division at the Norwegian Directorate of Health in Oslo, Norway.

The study had a first phase of fieldwork in the period January-June 2013 with a focus on understanding the overall vision for the portal. In this phase we have assembled and analysed a range of academic, government and industry studies, and programmatic and strategic government documents on the deployment of technologies in the Norwegian healthcare sector. A second phase of primary data collection started in August 2013 with intensive fieldwork. In this second phase we have specifically focused on one of the projects in the context of the national portal, namely the eDialogue project for GPs. In this paper we primarily focus on the trajectory of the eDialogue project from 2012 to August 2014.

Doing fieldwork we have attended project weekly meetings, workshops, and other thematic meetings where we took detailed notes. In addition, we have conducted open-ended semi-structured interviews (28) with members of the project team, including the project manager, and the management of the national portal. Interviews lasted approximately 1 hour each and have been recorded and fully transcribed. Finally, we reviewed preparatory meeting documents, presentation slides, reports, and project deliverables as we have been granted access to project documents.

The purpose of the case study is to generate conceptual understanding of how information infrastructures grow with a specific focus on the role played by the installed base (Eisenhardt, 1989). We have approached the data by first reconstructing the history of the project since 2012, and by identifying the main events, and second by identifying specific thematic discussion. In particular we have focused on discussions on key architectural decisions. These discussions expose the work of creating the infrastructure which we have studied by following an interpretive stance to make sense of the data and thus primarily by attending to the meaning people assigned to events and discussions, with a special focus towards designing the architecture (Klein & Myers, 1999; Orlikowski & Baroudi, 1991; Walsham, 1995). The concept of installed base has helped us to focus on the relationship between needs, capabilities and the existing technical components.

4 Case Description

The discussion about creating eDialogue services between citizens and their GPs started in 2012 with a preparatory study. The final report from this first study identified that "*the various care professionals and health institutions have largely similar needs for secure digital dialogue with their patients as bi-directional communication, and that the processes around appointments, e-consultation and document/ form exchanges are generic processes that can be transferred from a care professional- or professional area to another*". Thus, the outcome of the study was the specification of four key eDialogue services: booking of appointments, renewal of prescriptions, e-contact and e-consultation and the prioritisation of primary care institutions. After the conclusion of the study in September 2012, a

pre-project was run to evaluate the feasibility, relevance and expected benefits of the services. The final report was released early in 2013 and confirmed the desirability of all four services. It further specified that: “*the technical solution architecture that will realize [eDialogue] must support a complex electronic interaction between citizens and care givers. The architecture will realize synchronous and asynchronous interactions in a safe and efficient manner. For this there is a need for new solution components, message standards and integrations*”. Subsequently, a project started in spring 2013 with the aim to design and implement the four services. The services are now (autumn 2014) in testing phase and a pilot will run in 2015 in a number of GP offices.

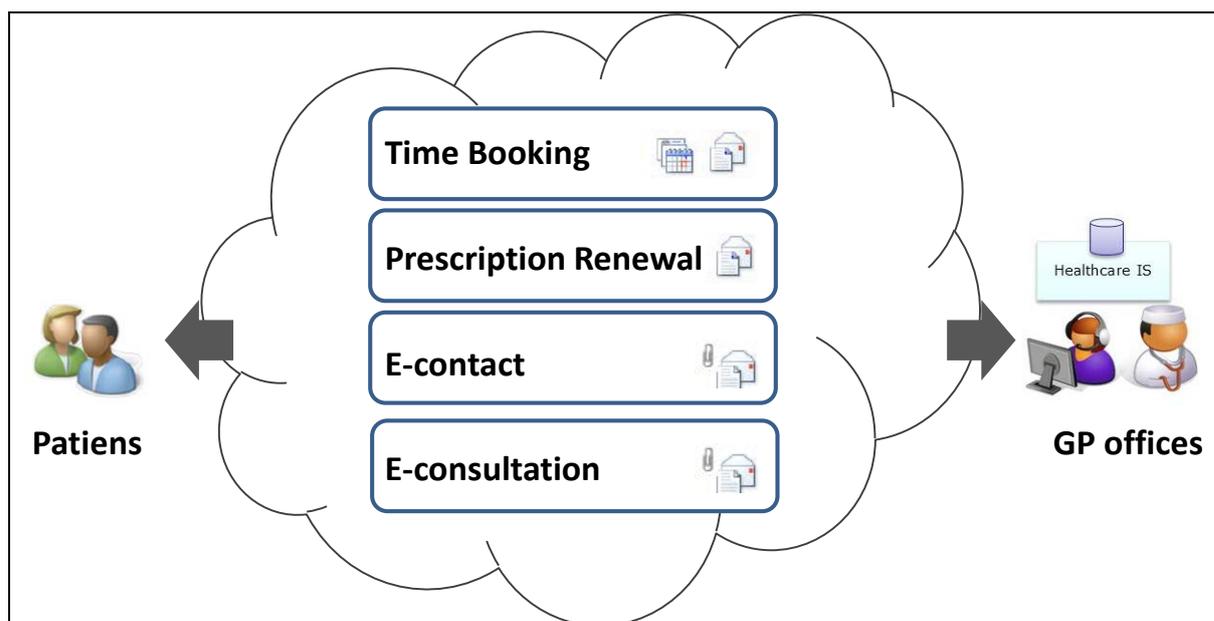


Figure 1: The four services for eDialogue.

The services are to be offered via the national eHealth portal which provides both open access services and services that require users' authentication. For the services requiring authentication the highest security level is implemented as stipulated by the law for the treatment of personal health information. When the new services will be launched, authenticated citizens will be able to exchange dialogue messages with their GPs. Messages would be presented on a timeline together with other documents and information. The adoption and use of the new services will not be mandatory for the GPs. The role of the national initiative is to make those services available to all the GPs, but it is their decision to take them into use. However, a recent change in the GP law implemented in January 2013 states that GPs should offer to their patients an electronic service for booking appointments.

In the analysis of the case we focus on three key decisions shaping the architecture of the national platform in view of an infrastructure perspective. Specifically our aim is to expose and analyse the views and reasoning behind these decisions. The first decision was to link the healthcare providers' side with the citizens via the existing GPs' Electronic Patient Record (EPR) systems, and consequently engage with the EPR vendors in the development of a new EPR module for the new services. The second decision was to create a message solution to enable communication flow between the EPRs and the national eHealth portal. The third decision was to purchase a new component for the secure storage of the messages created by the use of the new services. These are three decisions that shaped the architecture of the overall solution.

5 Analysis

The analysis foregrounds how the project related to the existing systems and how the architectural decisions taken affected the overall configuration of the infrastructure. Examining the project decisions on architecture through the lens of installed base concept provides us a rich understanding of how the actors in the project related to the existing components in the installed base.

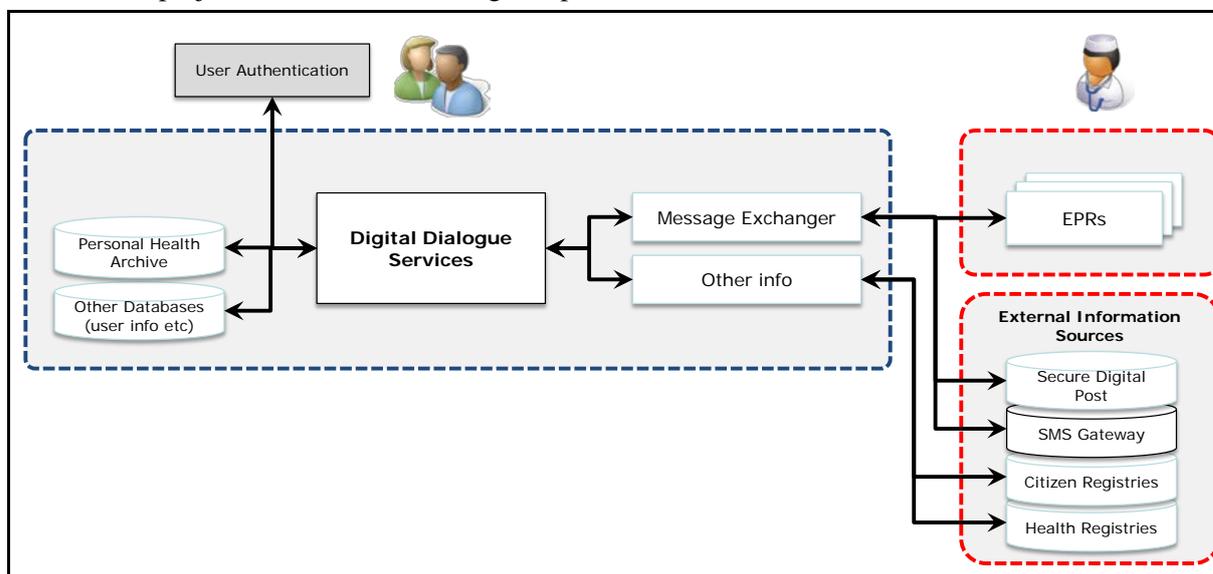


Figure 2: Architecture for the eDialogue services.

5.1 The decision about the EPR systems

During the pre-study of the eDialogue project it was discussed how to set up the services. For instance one possibility was to link the national portal with the existing private eHealth solutions in the market that some GP offices already were using to post information to their patients. Some of these solutions had also functionality for booking appointment and renewing prescriptions and medical certificates. These solutions and their users – both GPs, administrative personnel in the offices and patients - represented a possible installed base for the new eDialogue services. Technically this would have implied to redirect users from helsenorge.no to the private portals. From the user side, it would have meant to enrol first those users that were already accustomed to message-based communication between patients and GPs. However this base was considered weak for several reasons and it was decided not to link the portal to the existing eHealth solutions.

Specifically, three main concerns were raised at the time of the pre-study. First, the private eHealth GP's portals on the market did not have implemented the security level required by law (defined as level 4, the highest security level for access and protection of sensitive information). Second, these solutions were many and very diverse. They ranged from a solid product developed by a mid-size company also producing EPR systems, to home-grown makeshift web pages. This diversity was seen as problematic. An informant recalled: *“we found that for the citizens it would be best that we created an equal right, an equal opportunity for every citizen regardless of where you lived, what kind of doctor you had”*. Third, the user experience was evaluated as becoming too complicated and fragmented in a scenario where the national portal would redirect to the GP's own page. An informant said that *“the argument was that the users would expect to have everything in one place to build their own timeline of data”*. Among the mentioned concerns, the one about security was considered the most serious; if the national portal linked to external webpages, it would still be responsible for the security and quality of the overall solution. Later, during the eDialogue project, an assessment of the actual use of the private eHealth solutions in the country was performed. The assessment re-affirmed the per-

ceived weakness of the installed base of private eHealth portals by proving that they were very diverse in their offer of services and that about 40% of citizens did not have access to any digital service at their GPs. The report also pointed to the problematic use of the existing solutions for the communication of health information as their security level did not follow the legal requirements.

However, not linking to the GPs portals created many uncertainties. First of all, GPs portals already contained some data on interaction between citizens and their GPs. These data would not be linked to the national portal. Second, the GPs and citizens already using a portal were early adopters of eHealth technologies and most likely to be the ones starting using the new national solution. However, now a switching problem was raised: these users would need to abandon their installed solution and adopt the national one instead.

As a result of the weakness of the installed base of eHealth solutions, it was decided to link the healthcare providers' side with the citizens via the existing GPs' EPR systems. The reasoning in the eDialogue project at this point was twofold. First, all GP offices have an EPR system, while few had a portal for their patients. Thus it was decided to work with the EPRs vendors and enrol them in the project. The EPRs vendors were considered strong partners as they would bring into the project their installed base of capabilities and knowledge about GP's office practices. For instance vendor could contribute with knowledge and experience gained from their established user panels that participated in the development and improvement of the EPR systems.

Second, it was decided to address the switching and adoption problem by attracting users to the 'national' character of the solution in contrast to the stand alone GP's web page. The vision of the national eHealth portal is to give access to organized information from different sources that would form a timeline of contacts with the health providers accumulating messages, prescriptions, certificates, appointments, diagnosis, and discharge letters in one secure site. Thus, it was important for the project to focus on contextualising the eDialogue services in the portal.

5.2 The decision about the message mechanism

The decision to link the healthcare providers' side with the citizens via the existing GPs' EPR systems created the need to decide how to set up the linkage itself. In Norway, healthcare organisations are connected via a secure telecommunications network developed and managed by a government enterprise (NHN). Currently 98% of general practitioners, 97% of municipalities, all hospitals and all pharmacies are connected (Norsk Helsenet, 2014). Although the secure network is already in place, there is no mechanism to route messages between doctors and the national eHealth portal. During the project it was discussed how routing should be conceptualised and supported and also who would develop it and own it.

The project participants soon realised that it was a "cross cutting concern": other actors in the sector would also need some kind of mechanism for routing messages from the eHealth portal to external applications. This concern escalated the discussion outside the eDialogue project. An informant said: *"a solution that is just for us would not help the sector at all because if one doctor wants to communicate with the hospital or two doctors with each other, or the public health institute with a doctor, this solution would not help"*. This escalation of discussions was expected: although the project team had a specific mandate for the realisation of the eDialogue services, they were also required to adhere to the architectural principles defined by the Agency for Public Management and eGovernment (Difi). These principles have to be used for any development or significant restructuring of Norwegian public sector ICT systems (Norwegian Ministry of Government Administration and Reform, 2009). Difi clearly defines "flexibility" as a principle to be used. Specifically, the flexibility principle stipulates: *"any solution that is established must be developed in a manner that enables it to be reused in other contexts and within other frameworks"* (DIFI, 2009).

The overall sector's need for a routing mechanism concerned two interrelated aspects: one was about the logic of the solution, and the other was about its technical implementation and maintenance. An

informant explained: “we ended up calling it ‘message exchanger’ because we wanted to illustrate that this was something that did not have any knowledge about what was being communicated, it did not know that this is a message of this type and this is an e-consultation, it should be really stupid, and it should just know that there are two actors that need to communicate, and it should just pass messages through”. In order to implement such “message exchanger” multiple possibilities were evaluated. One idea was to base it on a solution developed by a previous project that “proposed to make the whole solution, but it would be hard to code and we would need to hire developers”. In addition, patching the already existing solutions would not only be technically complicated but it would also result in a mechanism that might not be flexible and reusable enough.

Then, discussions started about having the “message exchanger” developed and maintained by NHN (the network provider). This would mean that an additional actor (that was already related to the project and had a key responsibility for the actualisation of the service by providing the network) would be involved. The benefit of this option was that it would allow the development of a more generic routing mechanism with limited involvement of project’s technical members. As NHN is another governmental entity (fully owned by the Ministry of Health and Care Services) the full delegation of the linkage is politically unproblematic and it also creates better opportunities for further reuse. An informant explained the merits of the solution: “the one we ended up with, once established you don’t have to do anything to it, it just takes the message out, address to this, put it there”.

What might look from the outside as an “obvious” solution of the problem and a good way to build upon a key component of the existing infrastructure (both the physical network and an organisation with technical capabilities) has only been possible because a) both a process of concretising the current needs of the project and of gaining an understanding about future needs had taken place, b) an awareness of the benefits and drawbacks of alternatives available was developed and, c) the current capabilities of the organisation that is running the project were taken into account. Hence, the specific way that the installed base was mobilised for the “message exchanger” came out of a number of contingencies. The decision has as much to do with the characteristics of the pre-existing infrastructural components (NHN) as with the characteristics of the project team, the technical decisions that were already taken and the overall public sector ICT regulation. All of these aspects shaped the decision.

5.3 The decision about the archive solution

During the pre-study of the eDialogue project, it was realized that a dialogue service would not only need to facilitate the transfer of messages but it would also have to support citizens to access the messages created and exchanged in their digital interaction with their GPs. From the healthcare providers’ side the messages would be sent from the EPR systems and consequently, they could be stored there and considered part of the patient record. However, storing them only at the EPRs would not be a good solution for ensuring accessibility. For instance, GPs would likely switch off their computers after working hours or might have temporary network connection problems that would disrupt access to the messages exchanged. In addition, if the messages were to be stored locally in the GPs’ EPR system, it would not be possible for the citizen to access them anymore after changing GP. Contrary to the previous decision to build on the EPR systems and not on the private eHealth portals, the discussion about the need for storing the dialogue messages regarded the EPR systems as a weak base. They would not be reliable and accessible. Thus the pre-study participants identified the need for a solution to the message storage problem. Afterwards, the pre-project team defined a storage solution, provisionally named ‘personal health archive’, which could be available to citizens 24/7 and enable them to read their messages. However, during the feasibility study this ‘need for storage’ was not specified further and as one of the informants recalls it remained a vague concept that could become anything varying from “something very small, only for this project” or “potentially a key component for the portal”. In addition, it was not considered a priority. An informant says: “we needed some kind of storage and that was not the biggest deal, there were so many other things around the dialogue process, the security, and how to operate the different work processes of the doctors, and this storing some small pieces

of information, and it is not much, it is not very complicated, it did not get much attention, we just needed a database”.

In August 2013, as part of the eDialogue project, the requirement specification for the archive started. An informant says: *“the realisation of a need for creating this solution of storage came up, but as a component and my impression is that it was kind of a minor component in the larger project”.* At that point the archive was envisioned with a limited scope, basically responding to the need for storage of the eDialogue project and similar storage needs. The team considered to develop such solution in-house. However, this option was discarded based on concerns over the need for scalability. In the future it would be possible to exchange messages from the hospitals including heavy image files from the picture archiving and communication systems and extracts from records. An informant explains: *“So that a hospital doesn’t print out and sends to a patient, but the patient can access his or her information in only one place, and whether it is information generated or synchronised, you will find it in one place, and you decide if you want to print it out or if you want to download”.* Thus, in the course of the specification work, in the autumn 2013, the specification of requirements was driven by two aims: one was the immediate storage needs of the eDialogue project and of another similar project that in the meantime had just started after the summer (2013) designing interactive services towards hospitals, and the other was the possible future usages of the archive in other not-yet-defined services. This second aim was considered a *“strategic element”*.

The requirements for the archive were assessed against other storage solutions already in use in the context of existing e-government services and ongoing initiatives (as the DIFI initiative for the development of a secure digital mailbox). However these solutions were considered problematic. One issue was that some were unidirectional: the citizen would only receive messages from the public authorities, for instance from the public school or from the municipality. Differently, the solution needed for eHealth services would have to support dialogue: the citizen does not ‘receive’ a message but actually has an interactive experience. Another issue was that there was no possibility of decoupling between presentation, storage and message infrastructure. This meant that messages stored in the mailbox solution could not be contextualised within the eHealth portal. Another concern related to privacy and security. The team wanted to go for a high level of security but by looking at the specifications of other storage solutions even within the healthcare sector they realised that not all of them would provide good encryption support. Furthermore, as discussions kept going on, it became evident that it would be good to retain the control over the storage solution. An informant clarified: *“When you have the health archive at least you are in control of documents and the storage. You could create different views for the users when they log in based on what is in the archive the creation of a reliable and expandable storage solution”.* Also, the project team realised that there is a great potential for future developments based on the archive and that it could become a central piece in the Norwegian Healthcare information infrastructure: *“maybe, we do not know, maybe the archive will have an important role, it will be the place where you take information from one part of the health service and send it to another (...) potentially we talk of terabytes and petabytes, so it is big, if this is widely used it will probably be in a few years the biggest database in Norway”.*

These discussions led to the final decision to procure a storage solution instead of trying to reuse an existing one or to develop one in-house. An informant explains: *“a standard solution is giving us quite a few things, it is stable, it is well proven so we know it works, it has been handling huge databases for other customers around the world, so we know is capable of taking this amount of data, it is of course secure, it has very good support for security within the solution, and all the kind of basic services you need like putting in documents, deleting, changing who can access a document, logging everything that is happening, all these are kind of standard”.*

For the external observer, the decision to embark in a public procurement process and start getting engaged with yet another technology provider seems strange for a setting where all efforts are made to ensure reuse of pre-existing components and when the stated need is “storage”. Still, taking a closer look at the decision process we realise that it came out of the need to proactively prepare for a future

that seems to be approaching and to ensure the durability of the outcomes of the project. Since the team is building a national eHealth portal, the scalability concern is of outmost importance. Also, the awareness of the limitations of the internal capabilities of the team played a role.

6 Discussion and conclusion

In our study we investigated the effort to create the architecture supporting a national eHealth infrastructure. Our findings suggest that the decision on the design of the architecture were grounded in discussions on the quality of the existing installed base. However, while in the case of the EPR systems the discussion concerned the solidity of the base, in the case of the message infrastructure it was more a matter of negotiating a balanced solution between competing logics. Finally in the case of the archive, the discussion played the present and future needs of the services against the existing installed base of available solutions.

One contribution of our research is to demonstrate the influence of the installed base in the design of infrastructures. Our presentation of the literature on the concept of installed base in infrastructure studies pointed to a recognition that the existing components, capabilities, practices etc. influence the development of infrastructures. Infrastructures are not designed from scratch as in a greenfield situation (Hanseth & Lyytinen, 2010) but rather one must design at the same time *with* and *against* the installed base (Hanseth, 2000). In our empirical material we have tried to expose and be specific about the diversity of concerns and needs that guided the decisions to deal with the installed base of the architecture of the national eHealth solution. We have also tried to expose and be specific about the heterogeneity of the installed base in a relational view emphasising how components may play different roles. For instance the EPR systems play a central role in the installed base for the eDialogue project. However their role depended on the needs and concerns of the project participant in relation to specific decisions. On the one hand, the EPR systems were considered a weak base to build on when it comes to storing the messages between GPs and patients; while on the other hand, they were considered a strong enough base to link with the national eHealth portal on the side of the GPs. Thus, we contribute to the literature on the enabling and constraining character of the installed base by offering a detailed understanding of such processes.

A second contribution of our research is to demonstrate insights gained from taking a sociotechnical perspective on IT architectures, specifically in II development (Aanestad et al., 2014; Grisot et al., 2014). Not all infrastructures face the same challenges in relation to the installed base: a national public infrastructure is not the same as one confined within a single organization or one being built as a result of a private initiative. The development of national public infrastructures is shaped by overarching inclusiveness, flexibility and durability concerns. For instance, in our case the design of the message exchanger was driven by a concern to create a generic component that would enable message flow in the context of services other than those of the eDialogue project. These concerns influenced the architectural decisions.

A third contribution of our research is to demonstrate how the concept of installed base helps to articulate a current challenge in the design of eHealth solutions. eHealth solutions are being designed and implemented in a sector filled with information technology at all levels. The eHealth solutions, that are currently being designed and implemented in many countries, play against a densely populated installed base already shaped by the previous waves of digitization. Not only there is a need to bring all the existing pieces together but there is also a gap between an installed base of information system that adhered to a local, organizational, process logic, and eHealth solution that aim at cutting across healthcare providers and offering patient-centred services: *“The “enterprise” is too small a building block for health care, and models that start with national context, scale, and complexity might serve health care better”* (Avison & Young, 2007).

In conclusion, we offer a case study illustrating the challenging of creating the architecture for a national eHealth solution. We suggest that the concept of installed base is useful to expose these chal-

lenges and that a relational view on the installed base helps to be specific about it. On a practical level, our findings indicate the need for raising awareness about the complexities of designing solutions in a space already filled with technologies, as the health sector. We recognize that this study offers a partial view on the interpretation of the case as our primary data are from the perspective of the main actor in the design process. For instance we have not interviewed (yet) representative on the vendors' side or on the GPs side. Our future research will include also other relevant stakeholders.

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