A Survey - Software Ecosystem in Telemedicine

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Abstract— this paper is the survey about the software ecosystem in telemedicine. Telemedicine provides the health care at the farness; minimize the cost and improving the quality of health care system. In this paper we analyzed the existing software ecosystem and the design of the new software ecosystem towards the telemedicine environment. The software ecosystem mainly focuses on the major areas like defining the system that captures organization, software aspects and business of the software ecosystem. In telemedicine software ecosystem brings a new way of approach that provides the existing access of the telemedicine across the globe.

Keywords – Architectural design, software ecosystem, defining the system, improving the quality of health care.

1 INTRODUCTION

Telemedicine systems in a patient's home promise increased quality of life and less national expense. software ecosystems as the study of the complex interaction between extensible software architectures and software frameworks in one hand, and society, developers, people, users, and businesses on the other hand. Telemedicine system is a part of tele-health, which is based on the technologies by using telecommunication for the interaction between health professionals and patients in order to fulfill the distance medical actions. In today's world Telemedicine is a very vast area and it is widely used to re-modify the systems in the health care. Telemedicine is helping different healthcare system to solve the problems in different ways. Thus, the telemedicine system aims to provide expert-based health care to understaffed remote sites and advanced emergency care through modern telecommunication and information technologies.

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2 ARCHITECTURE OF SOFTWARE ECOSYSTEM

The architecture of a software ecosystem is the set of structures needed to reason about the software ecosystem, and it comprises software elements and actors, relations between them, and their properties. The main purpose of software ecosystem actors is to create value for-profit or non-profit manner and thus the business structure of a software ecosystem becomes Relevant. Finally, the software ecosystem is important to control the interactions and organization of actors and software .For example an actor to provide software- based service in the ecosystem and thus the organizational structure of a software ecosystem becomes important.

A. Organizational structure

The software ecosystem of an organizational structure contains actor and software elements that are related to the administration of the interaction and organization of the elements in the ecosystem. The Important aspects of the organizational structure are the actor and software elements included the boundary of the software ecosystem they define, and how the structure controls the interactions and support coordination between actors and the software elements.

B. Business structure

The business structure contains actor and software elements that are related to how actors create, deliver, and capture value. A business model describes the rationale of how a system creates, distributes, and captures value.

C. Software structure

The software structure contains actor and software elements that are related to the production of applications in the ecosystem. The initial actors are developers of the software ecosystem platform and of applications. Software

elements may be seen as consisting of multiple structures such as units of code, runtime functions like plug-in, or formation nodes.

3 THE EVOLUTION OF TELEMEDICINE

Telemedicine, the use of latest telecommunication technologies that provides health care services over more distance, has a history that spread more than five decades. Technological development and distribution have been interrelated with shifting prototypical views. That the telemedicine has evolved through three generations that began with telemedicine as a communication medium to complement conventional services to a technology of automation tools that expands the scope and range of health care services and creates a particular health communication context. This survey provides a literature review and overview of latest evolutionary stages for telemedicine that, namely asynchronous versus synchronous methods, storage and data transfer, and automatic decision making with expert systems. We conclude with a discussion of the software ecosystem in telemedicine and a call for engineers to join with social scientists and medical professionals, doctors to set a plan for future telemedicine development.

4 DANISH TELEMEDICINE ECOSYSTEM

This is focus on telemedicine as an application system for software ecosystems in the Danish healthcare. The delivery of healthcare systems, where scope is a particular factor, by all health care specialists using information and communication technologies for the exchange of valid information, analysis and prevention of disease and injuries, evaluation and research, for the continuing improvements of health care providers, all in the interests of promote the health of individuals and their society. They analyzed the organizational structure of telemedicine in Denmark; they developed to address need of increased uptake, and the issues the guideline is intended to address. Next they provided the more detailed analysis of resent issues based on the business and software structures of the software ecosystem architecture. Finally, they outline the challenges remaining in the ecosystem under study.

A. Organizational structure

In an organization structure of Denmark telemedicine services is part of the healthcare services provided by the public healthcare system. The telemedicine ecosystem is maintained by the same administrative members as the generic healthcare. The organization of the healthcare system is quite decentralized and it has three administrative levels. Those levels are state level and Regional level and local level. A main issue is the relations among the different item listed above, and the kind of analysis and predictability that these relations support. As an outcome of this, telemedicine in Denmark has been described by hundreds of ungraceful, small type of projects, each developing their own solutions, including framework of the particular system. Those solutions are not able to share data between the telemedicine systems, due to lack of common framework, and they most often abandon when the resources of the project are utilized. This has resulted in more than 350 current telemedicine system initiatives of which the minority is in production.

B. Business structure

This Danish healthcare project aims at bringing expert diagnosis and treatment of ulcers to patients through the use of a mobile phone with a camera and a web-based electronic telemedicine instruments. The rationale behind this project is that expert ulcer diagnosis for patients with limited mobility (e.g., elderly) is expensive but at the same time necessary as these patients are in the high risk of developing severe ulcer complications often resulting in amputations.

C. Software structure

There are many issues are there in the software structure of the Danish telemedicine system. The major three issues are of course not orthogonal: increased reuse of the system leads to faster and more reliable development and thus to improved build ability, and reusing of storage systems and uniform data formats leads to easier integration between the systems. The issues, however, works strongly against a general emergence and evolution of a new software ecosystem. Without familiar and mutual software architectural standards, storage systems, data formats, system modules and information resources, development and integration is very complex, notably for small and medium sized business organizations.

5 NET4CARE SOFTWARE ECOSYSTEMS

The Net4Care software ecosystem provides the ability to create quality of tele-health applications quickly interfacing with HL7/PHMR and IHE/XDS. Net4Care ecosystem features a modular server and client and aims at providing support for a telemedicine software ecosystem. A typical deployment scenario is a tele-monitoring scenario in which Net4Care clients are deployed in patients' homes, and Medical devices that are connect to these clients and transmit their observations to a Net4Care server. In the Net4Care server creates valid clinical HL7/PHMR and stores them in a national IHE/XDS storage repository that in turn enables general practitioners and clinical staff to view observations.

In Net4Care they proposed to mitigate the learning curve as well as support small and medium businesses application development for telemedicine by providing an application-centric ecosystem for telemedicine and an open-source reference implementation of the core platform.

Outlines a set of success factors for application-centric ecosystems: a) large set of customers b) simplified contribution by third party developers c) ability to extend data models and workflows and d) a viable channel of exposure to customers. We hypothesize that few SMBs will enter a marketplace for telemedical applications as existing standards does not fulfill the simplified contribution requirement and those who do are unable to interoperate with existing public healthcare solutions, such as Electronic Health Records systems.

6 4S TELEMEDICINE ECOSYSTEM

The Foundation for Software-based Healthcare Services (4S) is an open source ecosystem for telemedicine and it has a providers and consumers. Members include the National e-Health Authority, who is responsible for setting the national standards for telemedicine in Denmark, three out of the five Danish regions ,who operate all secondary care and public hospitals, municipalities like primary health care and software providers, social care and the Alexandra Institute. The telemedicine ecosystem currently focuses the operators of 4S. 4S is working to promote collaboration between in and around the health related data, across private and public sectors. 4S is currently attracting on the use domains of telemedicine and telehealth care. Through the use of open technologies, reference frameworks and international specifications, the goal of the 4S telemedicine ecosystem is to make it easier, cheaper and faster to practically achieve better healthcare IT solutions.

7 EXPERIMENTAL RESULTS

All the above software ecosystem methods are experimentally verified in many of the telemedicine environments. Net4Care and OpenTele is the important tool on which build telemedicine applications. 4S ecosystem reduces the complexity of problem and solution domains by providing reusable components and services that incorporate national and international applications.

A. Net4care and opentele

Net4care software tool as showed how an emphasis on success methods for the application centric software in the telemedicine environment. It has the simplified contributions, work flows and extensible data models, and also it has had the well written online resources and testing environments. Opentele data collection system improves and extending the possibilities of the existing ecosystems. The existing actors in the Net4care are interested in the opentele ecosystem. Opentele as a various data collection capabilities. Opentele is a competitor for some of the companies making telemedicine systems.

B. 4s ecosystem

4s software ecosystems reduces the complexity of the problems like integrations and economies of scale. It provides more reusable components comparing to the software ecosystems. This system increasing the integration and interoperability by providing access to the national services in an interoperable way.

8 CONCLUSION

In this review paper, we have summarized the leading techniques for the software ecosystem in the telemedicine. The set of structures needed to reason about the software ecosystem which comprises actor and software elements. Most of the telemedicine tools that are developed by the open source software projects. We conclude that there is various Software architectures are available for telemedicine. We couldn't determine which one is best it depends on the type of the project used. We tried to present all the advanced Software architecture that is recently used in the Telemedicine ecosystem.

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