Trustworthy e-Health Services facilitating effective cooperation

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Abstract

Effective e-Health Services have to take the business perspective into account. This is achieved by deriving a four layer structure, thereby combining IT-related and business related layers. This structure is used for designing an e-Health service leading to distributed responsibilities and allowing for mutual cooperation in a state-wide approach. The reference implementation comprises a highly reliable central infrastructure providing second opinion, emergency consultation and remotely supervised examination in radiology. The implementation includes extended means to guarantee trustworthiness on multiple levels: (i) actively controlled network and application availability, (ii) automated routine performance tests fulfilling regulatory requirements and (iii) hub-to spoke and an end-to-end authentication. As a result, about half of the hospitals of the state have signed up to the services provided.

Keywords:

Health services, Quality assurance, Health telematics, Information management system

Introduction

Larger regional or state-wide e-Health services lead to additional requirements when compared to local, bilateral cooperation: (i) frequent changes in cooperation according to clinical needs, business opportunities and personal relationships, (ii) availability and continuity management as part of a professional IT-Service Management, (iii) scalability, training and maintenance, (iv) compliance to directives and regulations and (v) sustainability, in particular for e-Health projects which received an initial (public) funding and have to finance themselves beyond the projects' duration.

This poster presents a four layer approach extending three IT-related layers (domain layer, logical tool layer, physical tool layer) with a business perspective and presenting a reference implementation compliant to the requirements.

Methods

The reference implementation of the logical and physical tool layer uses a completely virtualized and centralized architecture to support high availability for enterprise functions such as: second opinion, emergency consultation and remotely supervised radiological examination. Hub-to-spoke reliability is supervised on network and application level ("ping", DICOM C-Echo) together with a scheduling and monitoring service (Nagios). Trustworthiness between an organization and the central infrastructure relies on establishing a VPN tunnel using pre-shared keys or certificates and DICOM credentials (IP, Port, AET). For an end-to-end authentication between organizations and/or individuals, data objects include a signature obtained from a nation-wide Health Telematics PKI. The signature procedure facilitates a hybrid approach to allow for efficient handling of large data volumes e.g. images. For regulatory requirements e.g. end-to-end availability and transfer times, a specific service has been developed which automatically performs the required checks and generates obligatory reports.

Besides these three IT-related layers, a fourth layer has been added to cover organizational and business processes for facilitating medical and clinical cooperation. As such, it allows for mutual contractual agreements on e-Health services like night duty fill-in, remote reading and reporting, remotely supervised examinations.

Results

By taking the business perspective into account, effective and sustainable e-Health Services have been accomplished by adding a fourth layer to an existing three layer model for the management of IT systems. For establishing e-Health Services on a larger scale, the responsibility for the layers has been split, thereby facilitating mutual cooperation. Out-sourcing the responsibility for the IT-related layers to an independent service provider has resulted in the design of a highly reliable infrastructure with reduced and shared costs for service provision. In addition to basic approaches like virtualization, trustworthiness has been established using continuous monitoring on the network and application level, end-to-end quality and performance testing as well as authentication.

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