Service-Oriented Architecture Supports Electronic Health Records

Effective healthcare provision relies on service-oriented architectures to realize electronic health records.

We see rapid adoption of service-oriented architectures (SOA) across industries. In healthcare however, for the time being they remain largely absent. We can point to a number of causes for this. Because an SOA is of great importance for the realization of an electronic health record (EHR) and the clinical and patient services they will support, it is important to understand these causes. A central role is reserved for the information managers of healthcare institutions: to translate the technical possibilities into new business and care delivery models.

Treating a patient

The diagnosis and treatment of a patient's health issue is often supported by access to information which is managed by various care providers and resides in various information systems. In order to support the quality of healthcare provision, it is necessary that this information is current and correct, can be positively associated with the patient sitting in the room, and can be interpreted in the same way by everyone involved with the information system. In reality, this appears to be a difficult task. For example, in the treatment of a diabetes patient, it is currently almost impossible to connect all the necessary information that is managed by the various healthcare institutions to each other.

Service Orientation

The new generation of IT makes it possible to create solutions through the integration of standardized “services”. Because services are much more intricate than the large information systems which we knew up to now, much more flexibility is created by the ease and speed of being able to renew processes and the underlying systems. Working with simplified services is a formidable weapon in the fight against the continuously increasing complexity, both as it pertains to technology as well as it pertains to processes and organizational structures. Once an organization has a hold on its “portfolio” of services, more insight is created as a matter of course in the costs and value of the parts of the portfolio. And that makes it possible to take decisions in an objective manner, for example about the merging, splitting and maybe even outsourcing of services. Implementation of an SOA offers the perspective to much more smoothly integrate with other businesses, suppliers, partners, and possibly in time also with the telemedicine and telecare systems of the patient.

Managers have not had the ability to sufficiently investigate strategic IT possibilities

The SOA concept has evolved to connect services (functionality) and information from different systems and organizations to each other (see box). This concept is exceptionally useful for linking applications in a distributed environment. In addition, SOA is also an answer to the increased complexity of organizations and of IT due to mergers and takeovers, increased competition, technological developments, and legal and regulatory issues. Subdividing the processes into a set of enterprise services can reduce these complexities. While in other sectors (for example, the financial world and telecom) SOA stands high on the agenda, we see few initiatives in healthcare as of yet. What is the cause of this?

Increased risk-taking

The execution and implementation of a service-oriented architecture stems from a corporate vision and strategy in which IT is an integral part. The current limited interest for SOA in healthcare indicates that the strategic possibilities for IT are still insufficiently investigated by directors and/or that there are still insufficient drivers to make healthcare institutions more versatile and flexible. Recent publications from various perspectives have called for increased market stimulation in healthcare and for increased entrepreneurship and risk-taking.

Aside from this, there is the interdependence of software suppliers and the complex and heterogeneous application environment of the current healthcare institutions or healthcare regions. An information manager of a hospital already quickly sees himself confronted with an existing application environment with various applications of ten to fifteen suppliers; many more in large institutions. The core is formed by a hospital information system (HIS), and linked to it a whole variety of applications with very specific functionalities: pharmacy, surgery, radiology, laboratories, etc. Often these applications also run on multiple platforms. Implementation of an SOA demands a thorough adjustment of these systems that often can only be done by the supplier.

Lack of a reference architecture for the sector is another important reason. A reference architecture contains among other things the rules for the design and construction of information systems. Because an SOA consists of a system of services that jointly supports the business processes, it is of vital importance that the sector has a set of rules at its disposal that stem from a common vision. An illustration is the method in which message routing between healthcare applications takes place now. In the past, particularly one-to-one interfaces were developed, causing the creation of an extensive and difficult to manage infrastructure. Without a reference architecture, an SOA will lead to a collection of independent services, which only increases the complexity.

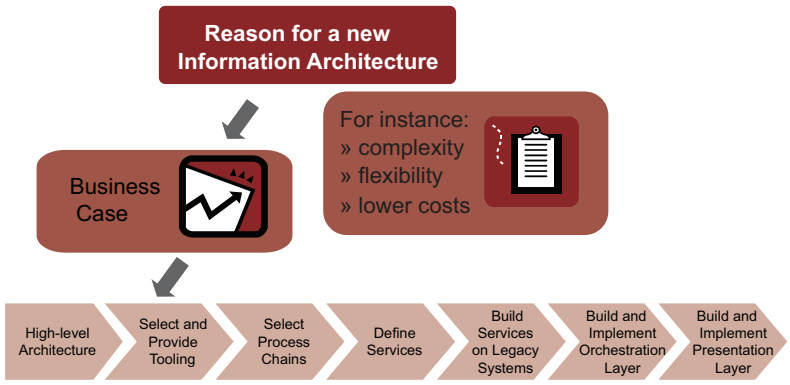
Major significance

Why can the SOA concept be greatly significant to healthcare? Two examples. The electronic health record (EHR) is often seen as the result of combining information collections from different information systems, for example from the family physician, pharmacist, hospital and nursing home. For long-term healthcare issues and chronic diseases such as diabetes, even more institutions and information systems are added to this. Information is collected and managed by all care providers who are involved in the treatment of the patient.

Notwithstanding this condition of physically distributed data, a care provider, for the effective treatment of this patient, must be able to possess all relevant and current information. This will become possible by the use of a reference index which tracks where the information of a patient is located. The various originating systems of the patient information must be able to deliver the relevant information at the moment that it is being requested, in other words, they must offer this "service".

The second example concerns claims processing of healthcare services. Before the delivered care service can be paid for by a healthcare payer, the dataset of this service and the invoice (claim and claim attachments) have gone through a large number of checks. One of these checks concerns the eligibility of the patient for the provided care service given his or her insurance. This is performed by multiple parties. It is efficient to construct this check as a 'service' once and to make it available to all. Multiple parties, as part of the claims process, make use of reference files that describe the various items and objects related to one claim. This may include, for example, a register of healthcare providers, of which the descriptive information (e.g. professional accreditation, institutional information) itself stems from yet another set of registers. Usually these registers are maintained by different national organizations. To be able to consult the most recent version of all this reference data, you could, at the moment of request, want to tie the central register and all supporting registers to each other. All involved registers should be able to offer this "information service". Actually, such a cooperation of services is comparable with the method in which the EHR can always be virtually composed, depending on the role, authorization, and needs of the individual requesting the information (for example, the medical specialist).

Figure 1: Seven steps to a service-oriented architecture



Returns

Service orientation has an effect on three domains of business operations: infrastructure, applications and data, and business services. For each of these domains, a business case can be made to evaluate which returns different changes in business operations can deliver, in order to be able to set priorities. Service-Oriented Infrastructure (1) is aimed at better sharing and managing of expensive infrastructural utilities. The heterogeneous complexity of servers, storage, security and network equipment is brought back to orderly, standardized services. Service-Oriented Applications (2) aims at the development of systems of cooperating services that can be quickly adjusted to new organizational requirements. In the Service-Oriented Enterprise domain (3) the new or modified applications and infrastructure are positioned for the support of business operations aimed at the exchange of services with the outside world. Characteristic of these new business operations is the capacity to cooperate intensely and intimately with other organizations, to be able to quickly reconfigure the business operations, and be able to in a flexible manner take advantage of new market opportunities.

Service orientation has an effect on all sections of business operations

A national or regional electronic health record, such as is currently being shaped by a number of government agencies, sets high requirements for the information architecture of healthcare providers. For instance, in The Netherlands the goals for the coming years are aimed primarily at the realization of a national professional summary record for family physicians and a national medication record. These are the first chapters of the intended national EHR. A similar approach is taken, for instance, by the NHS in England, where electronic prescription and appointment scheduling are the first priorities. In all cases the requirements on the information systems of individual healthcare providers and institutions are massive. The required modifications of applications are as of yet coming along with difficulty. In addition these modifications may only have a limited range, answering to the immediate needs of the first chapters of a national EHR. In order to make faster progress, both now and in the future, a more fundamental approach is necessary. SOA can be of great significance in this. A common healthcare reference architecture is a first requirement in this endeavor.

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