Investigating the IT Silo problem: From Strict to Adaptive mirroring between IT Architecture and Organisational Health Services

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Abstract. A crucial problem reducing efficient information flow within healthcare is the presence of siloed IT architectures. Siloed IT Architectures causes disruptive and disconnected information flow within and between health institutions, and complicates the establishment of qualitative health services to practitioners and citizens. In this paper, we analyze this challenge using a mirroring lens. Our research question is, how can we establish a supportive IT architecture that reduces the IT silo problem? Our empirical evidence comes from a case in Norway, where we analyzed a transformation initiative on the national, regional, and local levels. Our investigation into the IT silo problem contributes to the literature on information flow and IT architecture within healthcare in two ways. First, we find that strict mirroring that leads to sub-optimization and silofication, is a major cause for the presence of IT silos. Second, we demonstrate how adaptive mirroring – a modular strategy for combining global and local requirements in IT architecture – improves the changeability and manageability of IT architectures.

Keywords: IT architecture, Healthcare, IT Silo problem, Adaptive mirroring

1 Introduction

In this paper, we investigate the IT silo problem in large IT architectures in healthcare, as well as how it can potentially be solved. The problem is often associated with non-modularized legacy systems without suitable system interfaces [1]. IT silos are a known problem in incumbent firms [2] not least within healthcare [3].

Healthcare organisations can be seen as professional bureaucracies [4] consisting of multiple specialized practices such as neurology, pathology, oncology, heart surgery, and so on. Also, since physicians are central to resource allocation and care processes in the hospital, they are typically independent of hospital management [3]. Healthcare IT architectures are thus characterized by a high degree of diversity granted to the practice environment but a low degree of integration between institutions [5]. The clinical expertise must have the freedom to innovate, but innovation based on local and particular needs often challenges the flow of information across health units and may create disruptive and disconnected health services [3], [6]. Multiple non-standardized and disconnected health services dominated by different knowledge standards, paper records, and discs cause slow information flow and reduce the effectiveness and quality of the performance [5], [7]. Specialized clinical practices are, thus, considered a main cause of the IT silo problem, since multiple unintegrated systems challenge the fundamental task of coordination within the system as a whole [3], [6], [8].

At the same time, since these siloed architectures are portfolios of systems that have grown over time closely attached to the specialized practices they are intended to support, their legacy is very important for the institution as such [10]. This also means that a change process must take into account and maintain the specialized and knowledge-oriented content of the legacy systems.

Although the IT-silo problem is understandable, the result is somewhat less acceptable. How can we establish a more efficient digital practice, with consistent and efficient digital services, while leveraging the legacy base?

The relation between organisational activities and IT architecture can be understood as mirroring [11]. The mirroring hypothesis suggests "that the formal structure of an organisation will (or should) "mirror" the design of the underlying technical system" [9, p. 709]. We conceptualize this as strict mirroring [9].

While earlier theorization on this relation stressed the rationality behind strict mirroring between organisation and IT architecture [12], we address the challenges caused by this organisation as well as how they can be solved. Based on these interests, our research question is, *how can we establish a supportive IT architecture that reduces the IT silo problem?*

To address this question we build on and extend the concept of adaptive mirroring. Adaptive mirroring is within software engineering an architectural principle to enable information flow from several sources to the target system. In our framing, adaptive mirroring is an architectural combinatory device meant to facilitate the information flow between IT systems that supports organisational health services with distinct clinical information. To reach this goal the architecture needs to be modularized. We proceed by investigating how IT silos are addressed in the literature on healthcare IT and e-Health.

2 IT Silos in Healthcare: The Role of IT Architecture

The healthcare sector is one of the most complex institutions in our society but is also a sector urgently in need of dramatic innovations and change in the years to come. Increasing life expectancy and public expectations put the health system under pressure to accelerate the development of new digital services [13], [14]. These requirements enforce innovation in patient logistics. Patient logistics are costly but fundamental to achieving a more effective healthcare system [15],[14],[16]. Factors that constrain innovation activities are limited budgets, and a risk-averse non-innovative culture [13], [14]. One of the main reason for the cost and the complexity of innovation within healthcare are IT silos [17]. IT silos are seen as one of the main barriers to enabling innovation in hospitals [7].

IT silos emerge because healthcare organisations are professional bureaucracies [4] consisting of multiple specialized practices such as neurology, pathology, oncology, heart surgery, and so on. Physicians need freedom, to specialize and solve expertise-related tasks [18]. The organizing logic of the expertise may, however, challenge the fundamental task of coordination within and between hospital units [3], [6], [19]. Especially when expertise-related tasks are mirrored in the IT systems used by the expertise. As noted by Cebul et al., [3]"hospitals have a fragmented structure because of the

special role played by physicians. Physicians are central to resource allocation and care processes in the hospital, yet they are typically independent of hospital management". IT silos that support specialist practice is characterized by a high degree of local freedom and diversity, but a low degree of integration [5]. This means that challenges occur when the system needs to operate as a whole, across diverse local settings.

We identify two fundamental ways of improving the difficulties caused by lack of integration and effective coordination within healthcare in IS literature. The first is about facilitating innovation bottom-up based on the needs of the local communities. This means that the IT architecture must cultivate gradual growth from below and build integration elements that facilitate message exchange [10], [20].

The second is about establishing large enterprise architectures or monoliths to be able to integrate clinical applications in a manageable and holistic way [17].

Both of these approaches have strengths. One aligns with the expertise, is very concerned with the utility of what is being developed from a clinical perspective, but less concerned with the management requirements [1]. The other establishes strong managerial and hierarchical control [17]. Often, however, this structure is top-down, centralized, and reduces the pace of innovation at the local level.

This challenge could be solved by combining these two perspectives through platformisation [18], or dual transformation that introduces a combination of autonomy and alignment [2]. Since platformisation brings with it a completely different way of thinking and requires a radical restructuring of, not only the IT architecture but also the way the actors interact, this is very challenging within healthcare [18]. A more low-scale innovation effort could be to combine these two perspectives by distinguishing local level and global requirements. This could have been done by positioning the universal information elements and systems in a central repository, while the local requirements were facilitated through local configurations [21]. To shed light on this ambition, we proceed by describing our lens for theorizing the IT silo problem: the mirroring hypotheses, and develop the concept of adaptive mirroring to describe a capability for combining local and global requirements in IT architectures.

3 The mirroring hypotheses

The mirroring hypothesis is built on the insight that there is a structural correspondence between the architecture of a product or a system and the way labour is organized in the organisation [11]. This potentially means that each organisational unit has corresponding IT systems. Previous mirroring literature [11], [22] categories different degrees of mirroring into, *strict mirroring*, *partial mirroring*, *mirror-breaking*. We add to this apparatus by developing *adaptive mirroring* as a combinatory capability.

Strict mirroring means that the organisation and its IT architecture are primarily oriented towards internal organisational issues, and "mirror its own organisation but not that of its industry", and that "technical dependencies [are] correlated with communication linkages" [11, 720]. The perspective is suitable when IT is relatively stable and the complexity is manageable. Strict mirroring can be typical of organisations in very specific markets and knowledge organisations within the public sector like hospitals [3], [6].

IT systems that support specialized expertise are important characteristics of knowledge organisations. At the same time, this "introvert focus" creates challenges in two key areas. First, IT silos make it difficult to communicate digitally across siloed environments dominated by specialized practices [3]. Secondly, IT silos make it challenging to manage and change the IT portfolio when external conditions require it. Within healthcare siloed architecture is quite common [18].

A particular negative consequence of strict mirroring and IT silos is that "firms focused on the current technical architecture may fall victim to architectural innovations arising outside their boundaries"[9, 710]. This entails that strict mirroring complicates the process of exploring new requirements and solutions [11]. This is termed 'the mirroring trap'. As the pace of technological change increases and systems become more complex, organisations must also broaden their perspective and explore electronic markets.

Partial mirroring implies a more extrovert perspective in which firms explicitly invest in knowledge of technologies beyond their boundaries, and a looser link between organisational units and practices and the IT structure. Partial mirroring is especially important for organisations that operate in dynamic markets but also for institutions where the customer or citizen uses services that contain several specialized practices. Partial mirroring requires modularization and integration solutions that facilitate communication across specialized areas [11] through modular communication interfaces [23]. In such cases, organisations can gradually reach a more service-oriented architecture [24].

We introduce ***adaptive mirroring*** as a specific form of partial mirroring. In software engineering literature [25], [26] adaptive mirroring is the establishment of a service channel that facilitates the movement of data to and from the target system. This organisation of data flow enables the target system to adapt its behavior according to system and application needs from different types of actors. Adaptive mirroring thus addresses the problem of tight coupling. Tight coupling leads to entanglement and non-transparent relations between parts of the system. A modularized structure ensures loose coupling if it has a clearly defined area of function and responsibility. Adaptive mirroring is based on the modularization pattern that provides a looser coupling between modules and can be seen as a communication and combinatory capability that creates a looser connection between expertise and system needs. Adaptive mirroring, thus, removes the need for a close connection between expertise and technology. Adaptive mirroring is also based on a balance between variety at the local level and integration to strengthen centralized control [5]. Adaptive mirroring may thus be a capability to reduce silos and facilitate cross-coordination and management [3], but also to ensure the potential of local configurations.

We build on this insight to investigate how the relationship between organisational expertise and IT architecture can vary at different organisational levels, and how this may be combined to optimize performance across units. Examples are large organisations that need to divide between global and local services.

While incumbent organisations in both the private and public sectors struggle with the transition from strict mirroring to partial mirroring, born-digital firms are often digital in their basic structure. Examples are large digital platforms often organized as a "core-

periphery" organisational structure. The platform core is reachable for third-party innovation through boundary interfaces that release and secure the resources of the platform. This new form of an ecosystem [27], [28] is fundamentally extrovert; the whole point is to operate in multisided markets. Colfer and Baldwin frame this as *mirror-breaking*. This is very challenging within healthcare [18].

In summary, we use the mirroring lens to identify challenges introduced by siloed IT architecture and identify *adaptive mirroring* as a conceptual description to align local and global requirements. We proceed by describing our method.

4 Method

This is an in-depth qualitative case study [29] used to investigate the IT silo problem within healthcare. We studied a large-scale reform of the Norwegian health system where the government transferred the ownership of the hospitals from 19 counties to the government. We investigated the impact of the transformation on the IT silo problem on national, regional, and local levels.

4.1 Data collection

We use the national reform as a point of departure for an in-depth investigation into a particular region (Health South East – HSE) and a particular hospital within that region (Kalnes). The regional and the local level may have different requirements regarding IT Architecture, and different ways of addressing the IT silo problem. While the regional requirements address standardization and integration to improve cross-hospital digital interaction, the local level is occupied with an IT architecture that facilitates innovation through configurable user services. We collected data through 60 semi-structured interviews with managers, strategists, entrepreneurs, project managers, developers, and clinicians. We also performed approximately 60 hrs. observation at the local hospital and participated in more than 20 seminars and workshops. We also analyzed around 1000 pages of documents with strategic, technical, and organisational content, as well as documents from various governmental bodies.

4.2 Data analysis

We analyzed our data in 4 steps. First, we did longitudinal analyses of national and regional e-health projects from 2002-2019. Our point of departure was the national reform in 2002, and we identified a local innovation project where a new IT architecture was established to reduce the IT silo problem. Then we analysed each level in detail to investigate how a relationship between the organisational unit and the IT architecture was established, and how this relationship changed during the project. We used the mirroring lens to identify the consequences of IT silos at the three levels. We found that *adaptive mirroring* was central to describing the alignment between regional and local requirements. In the last step, we generalized our findings and found three particular challenges introduced by strict mirroring, as well as a possible way of dealing with the problem.

Table 1 Data analyses

Step	Activity	Outcome
1	Longitudinal analyses of national and regional e-health projects	Section 5.1- 5.2
2	In-depth analyses of a local innovation project	Section 5.3
3	Analyze the relationship between organisation and IT architecture using the mirroring lens	Section 5
4	Generalize the findings	Section 6

5 Findings

5.1 National level: Reform of the Norwegian Health Sector

Norway is a sparsely populated (5 million) but quite large country (324 000 km2). Hospitals are a central institution in the social democratic welfare system and spread around the country to be as close as possible to the citizen. This organisation is quite expensive and digitalization enables new ways of organizing and managing the system, as well as new ways of handling patient monitoring and treatment. Until 2000, 19 counties were in charge of the administration of the hospitals. This had some advantages in that decisions could be taken as close to the citizen as possible. The system had also important drawbacks. Yearly the 19 counties met up to discuss and agree upon budgeting. The negotiations between the 19 counties tended to be lengthy, cumbersome and characterized by local optimization. This organisation implied significant use of resources combined with poor financial management, insufficient degree of competence development, a limited amount of research, unclear divisions of overall responsibility, low level of goal management, as well as different management methods in each hospital [31]. Moreover, the treatment had huge qualitative differences, depending on where the patient lived, and the specialized practices were poorly coordinated. In 2002 the government decided to transfer the responsibility of the hospitals from the 19 counties to the central government. They established 5 health regions.

Organisational change: The reform aimed to reduce challenges caused by local optimization to ensure equity of access to health services for citizens in all parts of the country [30]. However, the hospitals and experts are often granted extensive liberty, and the reform built on this to organize each region as a corporation. The five health regions established boards and ownership control was delegated to these boards. This means that while the government took charge and established national ownership, there was a decentralization of governance to each region [30]. At the same time, through its new role, the central government needed to secure overall coordination wherever this was necessary and appropriate ministerial responsibility. This implied strong vertical coordination and strong sector ministries that challenged the autonomy of the health enterprise [30].

Architectural change: A great deal of effort and large amounts of money was used to establish electronic patient records (EPR) at each hospital. EPR's are seen as central in enabling more efficient patient care, lowering costs, and standardizing information

flow. Each hospital got extensive liberty to address its own needs. As each region and every hospital had its IT budget an abundant flora of IT systems was developed, without centrally governed strategies [32]. The reform, thus, had no IT strategy. The visionary strategy policies written during this period expressed the need to use the Internet and the newly established "health network" (Helsenettet) to create standardized messages to coordinate between systems and devices. A visionary document stated:

> "A basic principle for a national health network is that one access point, a platform, should be able to support a wide and integrated range of services for electronic interaction, both email, mediation exchange, telemedicine and access to the Internet" [9]

Strict Local Mirroring: While the Government quite intrusively reorganized the system and implemented 5 health regions, and transferred around 40 hospitals to these regions, the attempts to solve the challenges caused by lack of digital interaction and disruptive information flow were much less intrusive. Apart from some visions on the use of the Internet and a large national supply chain ("Helsenettet"), the task of improving the state of siloed architecture at each hospital was left to the five regions.

The individual hospital, on the other hand, was granted extended autonomy and allowed to continue building their system portfolios undisturbed by regional management. These non-standardized systems had often emerged bottom-up, created by local vendors or even clinicians. These local silos made digital interaction between hospitals challenging. We see this as strict local mirroring, where the IT architecture is siloed, and systems are not integrated. This has two severe drawbacks. The system is very difficult to change and very challenging to manage.

5.2 Regional level: From strict local to strict centralized mirroring in Health South-East

Health South and Health East were merged into Health South-East (HSE) in 2007. HSE handles around 60% of the Norwegian population.

Organisational change: After the merging in 2007, HSE consisted of 11 Health Enterprises (HE) and over 20 hospitals. Although the Ministry of Health and the corporate board managed HSE, each HE took the daily decisions. The pre-established autonomy regarding responsibility and medical treatment remained, and studies demonstrate that the direct contact between HE and the political authorities was low [33].

Architectural change: The IT strategy became the most important centralizing factor in each region. Each region established an autonomous IT unit. In HSE, this IT strategy went through different phases [34], but the common denominator was centralized management of the interaction between the hospitals and the regional IT unit.

A crucial part of this strategic alignment consisted of creating a centralized architecture through a mega program called Digital Renewal. The architecture included a BizTalk integration factory. The factory was extremely complex but facilitated the exchange of digital messages between hospitals within a Health Enterprise (but not between Health Enterprises).

Strict Centralized Mirroring: HSE established a central IT unit and an integration architecture to address some of the coordination challenges between hospitals. The integration engine was very complex with 275 physical integrations and more than 700

system interfaces. The integration architecture required standardized messages, and the region consolidated the most important EPR system, reducing the number of local configurations. The change in the organizing logic from local variety to centralized integration meant that IT architects became important actors and that the central IT unit at HSE, Sykehuspartner, became an obligatory passage point for changes in the clinical systems. The new communication linkages governed by the integration engine mirrored a tightly coupled organisation dominated by the central IT unit and IT architects. This *strict centralized mirroring* significantly reduced the local autonomy to such an amount that local innovation became very difficult. This led to protests from hospitals and clinicians that demand a greater impact on the development of IT systems and architecture. The regional management established a new governance model to facilitate more local freedom. At the same time, there were also several innovation projects in HSE. One of these was Kalnes Hospital.

5.3 Local level: Adaptive mirroring aligning regional and local requirements at Kalnes Hospital

After several years working with the centralized IT architecture, there were still fundamental challenges, exemplified in this quote from an internal strategy document.

> "With today's ICT portfolio of applications and point-to-point integrations, Health South-East is unable to offer the necessary pace of change, sustainability, and scalability to adopt new and important functionality that supports the needs of the future. Information storage and end-user functionality are often designed in the same product and without open APIs, which has led to IT silos and technological complexity."

The Kalnes innovation project addressed some of these challenges. The hospital opened in November 2015, with both somatic and psychiatric services. Kalnes has 4800 employees, and Kalnes is the first digital hospital in Norway (HIMSS level 6).
Organisational change: The new CIO established a management team, and several project groups with specific goals in mind: (i) to create a digital hospital, (ii) to facilitate a hospital where the patient is at the center (patient's health care), (iii) to make sure that the patient flow is based on well-designed processes supported by IT throughout the clinic. The manager for the project said:

> "I had been engaged with the relationship of process innovation and IT the past 15 years, both theoretically and practically, and I knew what I wanted to achieve: hospital processes should be well defined and supported by information."

The management team started an innovation project with around 25 clinicians working on designing the clinical processes, and a separate group that worked with the process technology.
Architectural change: EPRs and other clinical systems can be seen as knowledge-oriented systems configured to optimize standardized clinical practices. These systems are not optimized to support efficient information sharing throughout the patient flow from admission to discharge. To support horizontal processes, and reduce double-registration and bureaucratic processes associated with patient flow, a better process system with more configurable user services was acquired from Imatis. The process technology consisted of check-in screens, mobile devices, and electronic whiteboards, i.e. user services

that enabled clinical personnel to configure the information to fit with the process flow. The process-oriented system also enabled integration towards logistics and alarm systems in the physical infrastructure, and thus facilitated integrated control mechanisms. Since the clinical systems with all relevant clinical information were part of the regional architecture, while the new Imatis system was only used by Kalnes, there was a need to integrate the two systems. The regional architectural "package" consisted of around 300 silo-applications, managed by the central IT unit in the region. A new interface had to be created between the "old" infrastructure and the new process system. Kalnes did much of this work. The result is a more modular architecture that includes innovative process IT that facilitates patient flow processes through configurable user services [27]. A nurse said:

"Imatis is very configurable, it lets us do many things other systems do not allow"

Adoptive Mirroring: Kalnes enjoyed the work done by the centralized IT unit to establish more consolidated and integrated systems with improved information flow. Kalnes developed the initiative further extensively by introducing a process technology that facilitated coordination across IT silos. This also included reducing the impact of strictly mirrored systems. In particular, the separation between knowledge systems (EPR, Lab systems, etc.) and locally configurable process systems (Imatis) created an IT architecture that significantly reduced the IT-silo problem. We refer to these combinatory capabilities as *adaptive mirroring*. Table 2 summarize our findings and lead us to the discussion and contribution.

Table 2 Overview of case level, action, and result in IT architecture

Case level	Action	Result in IT Architecture
National	Centralized organisation, local IT architecture	Strict local mirroring, no central management
Regional	Centralized IT Architecture	Strict centralized mirroring, limited local innovation
Local	Combined IT architecture	Adaptive mirroring

6 Discussion: From strict to adaptive mirroring

Our starting point was the IT silo problem, which is a significant barrier towards efficient information sharing within healthcare [7] [6] [3]. From a practical point of view, IT silos lead to disconnected information flow, lack of quality in services to the workers and the citizens, and IT architectures that are very difficult to manage. Our research aims to improve the understanding of the IT Silo problems [1], [3], [6]. To address this issue we ask, *how can we establish a supportive IT architecture that reduces the IT silo problem?* Table 2 summarize our findings. We analyzed the case using the mirroring lens [11], and provide two contributions regarding the IT silo problem. First, we identify and conceptualize *strict mirroring* as a central cause for the IT silo problem. Second, we bring forth a possible solution to the IT Silo problem in the healthcare context

by what we conceptualize as *adaptive mirroring.* We will now discuss some implications of these contributions.

6.1 Causes and consequences of IT silos

#Strict local mirroring

In the professional bureaucracies' form of organisation, specialties are mirrored in IT systems. This introduces a tendency of tight coupling between expertise and IT [3]. In some of the IS literature [10], [20], [35] the mirroring of IT and expertise is seen as favorable since the experts are the most capable in defining IT requirements [20]. One disadvantage with this organizing logic is *sub-optimization*. *Sub-optimization* regards the local use of resources at the expense of overall system performance. In our case, the hospitals within the 19 counties were granted extensive autonomy to configure their IT architecture according to the local expertise's needs. This had created rich and diverse IT architectures that mirrored the local requirements, but disruptive information flow between the hospitals. *Sub-optimization* occurs since the local expertise is primarily focused on a limited part of the healthcare system and is spared from the responsibility granted to system performance as such. *Sub-optimization* may lead to *siloification*. When each expert areas organizing logic is mirrored in their respective IT systems, the result is multiple systems that are poorly integrated or not integrated at all [3], [6]. This is often referred to as tight coupling [36]. Tight coupling is understandable since expertise always has some standard procedures to perform the work tasks [37], [38]. The drawbacks caused by tight coupling lead to IT architectures that are less manageable, less configurable, and more difficult to change [39].

#Strict centralized mirroring

The national reform had as its major goal to reduce IT silo architectures. In our case, the reform established a more centralized political control, but since there was no IT strategy, the hospitals continued as before. This meant that weaknesses caused by strict local mirroring (which were the main reason for the reform in the first place) remained unsolved. When the grip was tightened in each region (second level, HSE), a more centralized IT architecture was established. A central structure in the centralized IT architecture was the Biz Talk integration engine. The integration engine was established to integrate multiple local systems, and this required much effort and resources. The organizing logic of a central integration engine implied that autonomy was removed from the expert system into complex IT hubs governed by regional IT engineers [40]. This centralization logic reduced the autonomy granted to each hospital [34]. We refer to this as *strict centralized mirroring* since the regional authorities incorporate each hospital in a centralization logic that implies uniform performance independently of local particularities. This organizing logic entails that innovation becomes a centralized activity, performed at a level significantly distanced from the practice environments.

6.2 How can we establish a supportive IT architecture that reduces the IT silo problem?

We see *adaptive mirroring* as a combinatory capability that balances centralized standardization requirements and local requirements regarding innovation and configuration of user services. From a regional perspective, there is a need to establish more standardized IT architectures that can operate independently of organisational particularities, to facilitate seamless information flow between separate health units. This is done by establishing an architectural design that distinguishes between regional and local systems.

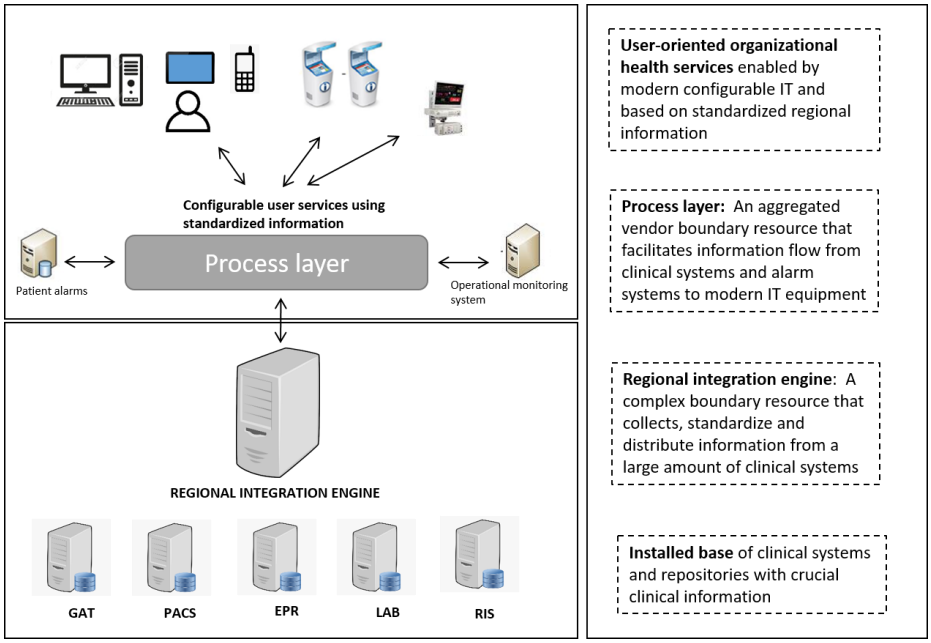

Figure 1 Adaptive mirroring architecture

The adaptive mirroring architecture (figure 1) consists of 4 layers. The first layer is the installed base of clinical systems and repositories with clinical information. These legacy systems are a crucial point of departure when more adaptive architectures are established [35]. The second layer is the regional integration engine, which is a complex boundary resource that collects and distributes clinical information [21]. This boundary resource is based on BizTalk technology, and through the Kalnes project, it was given an important role as a distributor of information to the process technology. The third layer is the local process layer, which is an aggregated vendor boundary resource that facilitates information flow from clinical systems to modern IT equipment [21]. This vendor boundary resource also facilitates integration with the physical infrastructure of logistics and alarm systems [21]. The fourth layer is the user-oriented organisational health services enabled by modern configurable IT (like smartphones, whiteboards, check-in screens, or medical-technical equipment) and based on standardized regional

information. The Kalnes innovation project is an empirical example of adaptive mirroring. The management group at Kalnes acknowledged the profound need for a process-oriented solution that provided configurable user services to clinical expertise [21]. The information was, however, harvested from the clinical systems through a regional integration engine. While the regional integration engine is used by all the hospitals, the process system was used by Kalnes. A modularized and layered architecture [36], is a good base for a more service-oriented architecture with less siloification.
The adaptively mirrored IT architecture (used by Kalnes) is loosely coupled [41] since it distinguishes between local and regional requirements, and between organisation and IT systems. This also means that the IT architecture will have more centralized control while simultaneously providing more appropriate user services [21], more local innovation [42] while maintaining regional requirements [43]. This type of adaptively mirrored IT architecture may also improve the manageability by using standardized IT products (like mobile technology) with flexible interfaces [40] [22]. Looser coupling between the expertise and the IT architecture technology may improve overall performance, and facilitate practice innovation. Adaptive mirroring also provides a connection between innovative discourses and an existing digital infrastructure [44].

7 Conclusion

In this paper, we analyse the IT silo problem in healthcare architectures using a mirroring lens. Our empirical evidence comes from a case in Norway, where we analyzed a national transformation initiative and its consequences on the regional and local levels. We contribute to the literature on information flow and IT architecture within healthcare by improving the understanding of the IT silo problem in two ways. First, we find that strict mirroring that leads to sub-optimization and silofication, is a major cause for the presence of IT Silos. Second, we demonstrate how adaptive mirroring – a modular strategy for combining global and local requirements in IT architecture – improves the changeability and manageability of IT architectures.

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