

Enterprise architecture principles for the Norwegian Specialist Healthcare. (English version.)

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Preface

The specialist healthcare's visions, goals, strategies and environments are fundamental guidelines that define the scope for the development of its enterprise architecture.

Laws, regulations, and rules, at all levels - from international via national to the enterprise-internal provide additional constraints. Technological possibilities and expected future developments also take part in shaping the enterprise architecture.

Architecture principles are brief and concise rules to help ensure that the specialist healthcare services are developed in line with these settings.

The architecture principles shall apply to all the domains of enterprise architecture: business, information, application and technology. The principles are designed to be able to work in interaction with other complementary principles in for example strategy design, organizational development system development as well as in technical areas.

Purpose

The principles apply to all projects and activities involving ICT in the specialist healthcare.

The purpose of these principles is to

- support the four main tasks of the hospitals (patient care, research, education of healthcare professionals, and the education and guidance of patients and relatives) in a way that safeguards the patient
- define the direction for the development of the business
- govern all projects and activities involving ICT
- serve as evaluation criteria for proposed changes, and serve as a foundation for making decisions related to portfolio management and enterprise architecture

The target audiences for the principles are

- decision makers who evaluate changes involving ICT
- enterprise architects who work on enterprise architecture development
- suppliers and others who need knowledge of the guidelines and constraints for future delivery assignments

Requirements for the properties of the principles

The principles shall have the following properties:

- **Stable** -The principles shall be stable for a long time, and not be tied to conditions that could potentially be changed quickly.
- **Robust** -The principles shall be robust, in the sense that they are designed to provide consistent and good guidelines for both the simple and the complex architectural challenges in specialist healthcare.
- **Complete** -The principles shall cover all aspects related to architectural decisions.
- **Consistent** -The principles shall be mutually consistent. There will not be aspects of a principle that is in direct contrast to the intent of a different principle. At the same time, there must be room for interpretations that provide the necessary flexibility.
- **Understandable** -The principles shall be comprehensible for the target group, and it shall be obvious what the purpose of the principle is.
- **Relevant** -The principles shall apply to issues of relevance for enterprise architecture.
- **General** - The principles shall be designed to provide overall guidelines, not detailed control.

The 9 principles are designed using the same template, where the principle statement is elaborated with background, and general guidelines on how the principle shall be followed. The principles are accompanied with an operational guideline that will provide additional support in specific projects and decision making situations. (To be developed later.)

The Principles

No	1
Name	Holistic approach
The Principle	A holistic approach is to be used when assessing needs, changes, opportunities and solutions. This involves taking into account the overall usefulness for the specialist healthcare as well as the sector at large.
Background	<p>Processes, organizations and ICT solutions are often designed to meet isolated, local needs. This makes it challenging to establish an effective cross-disciplinary collaboration across organizational boundaries, and reduces the opportunities for interaction in and between processes and ICT solutions. Interdisciplinary cooperation on, for example patient flow, will be demanding, and in many cases ICT is perceived as not supporting these processes.</p> <p>Decisions taken in a holistic and interdisciplinary perspective will have greater long-term value than the decisions taken in an isolated, local perspective. Systematic holistic thinking in the activities and projects will provide greater total value for the enterprise and the various organizations. The result will be more efficient interaction, and ICT solutions which to a greater extent will be designed to support this.</p>
How to follow the principle	<p>Needs and changes have to be viewed based on both the present situation and planned developments. For example: A change to a process will have to be evaluated in context with the adjacent processes. In addition, the implications for the use of the information, applications and technology have to be considered.</p> <p>Stakeholders from relevant professions must participate in the prioritization and development of business processes, services and underlying ICT-solutions.</p> <p>Projects and organizations must be prepared to let go of their own preferences if that provides a greater overall value.</p> <p>National guidelines are to be followed.</p>

No	2
Name	Process Orientation
Principle	The enterprises will through process orientation (e.g. patient flow and other core processes as well as supporting processes) realize consistent and coherent health care services, and ensure that ICT-solutions are designed to support these processes.
Background	<p>The processes tie enterprises together in order to create value. Considering the processes when designing ICT-solutions, will produce better decision making-and process support, to both individual tasks and interactions between enterprises.</p> <p>This perspective will also contribute to the harmonization and the use of best practices in the development of processes and ICT solutions. It may increase total added value and reduce costs for the businesses.</p>
How to follow the principle	<p>The enterprises have to keep track of their processes and how these are connected. The processes must be documented in a consistent and comprehensive manner, highlighting the information flow and dependencies to the supporting ICT-solutions.</p> <p>The enterprises must continuously work at process improvement in order to optimize quality and effectiveness, and simplify and/or automate interactions and tasks. The enterprises must ensure that appropriate ICT solutions are used to enhance and support the processes, today and in the future.</p> <p>Processes must have an owner who is responsible and accountable for their performance.</p> <p>Documented processes must be the basis for requirements given to ICT service providers. This will ensure that they focus on developing ICT solutions that provide optimal support for the specialist healthcare's processes.</p>

No	3
Name	Service Orientation
Principle	Service orientation shall be a basic design principle for enterprises and their ICT-solutions. This applies to all domains of enterprise architecture (business, information, application, and technology).
Background	<p>Service orientation is an approach and a procedure in which the information and functions are defined and delivered through services. Services provide reuse, preventing the same or similar services to be performed in multiple locations (by several service providers or ICT-solutions).</p> <p>Focusing on the patient is a central principle in the specialist healthcare's strategies, requiring changes in the approach to patient care. Service orientation can be an important instrument to achieve this. Service orientation supports and enables the functional distribution between hospitals, the patient's participation in their own health care and overall patient flow across hospitals units, enterprises and levels.</p> <p>ICT-solutions without a service oriented approach often appear isolated with a closed architecture and heavy dependencies in their internal structure. Such solutions are typically costly and time consuming to modify, and lead to duplication of information and functionality. This complexity makes managing large system portfolios challenging.</p> <p>Service orientation provides the following effects:</p> <ul style="list-style-type: none"> • Helps limit the duplication of information and functionality by providing a basis for common services, reuse and sharing. • Combines reusable services making it easier to offer patients services tailored to their specific scenarios. • Makes it easier to design and distribute public services aimed at self-service healthcare for patients and relatives. • Provides increased adaptability and stimulates the consolidation and standardization of related functions in all domains. • Facilitates reduction of supplier-and product dependencies, by enabling easier replacement of functionalities.
How to follow the principle	<p>The following guidelines will contribute to service-oriented solutions:</p> <ul style="list-style-type: none"> • New services shall be designed to support reuse and sharing, and when changes are required it shall be considered whether existing services can be used either directly or after modifying or enhancing the services. • Processes and ICT solutions shall be able to serve everyone with similar needs for a given service. This will be cost effective and contribute to standardization. • Services shall be built as components where the behaviour of the

	<p>service, seen from the outside, is only known through the service descriptions and well-defined interfaces.</p> <ul style="list-style-type: none">• It shall be possible to change a service with minimal impact on other services (i.e. loose coupling).• Re-use/sharing of functions in the various ICT solutions and use of shared public services shall be considered when developing, enhancing and procuring solutions. <p>Services can either be hospital specific, shared among several hospitals or nationwide. Services can be defined at different levels of detail, and a service can make use of other services.</p>
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No	4
Name	Interoperability (the capability to interact)
Principle	The enterprises and their ICT solutions shall be designed for interoperability at organizational, semantic and technical levels.
Background	<p>Patient flow involves many parties at different levels in healthcare. Information needs to be exchanged both between these parties, with the patient and with public and private parties outside the health sector. Within the specialist healthcare a patient flow often crosses boundaries between hospitals and organizational units, and information needs to be exchanged between several ICT-solutions.</p> <p>Interoperability aims to ensure that processes will perform as expected and that the right information is made available between healthcare enterprises and levels.</p>
How to follow the principle	<p>We distinguish between three different forms of interoperability: organizational, semantic and technical.</p> <p><i>Organizational interoperability</i> defines the organizations' ability to interact, and includes organizational units within the specialist healthcare, as well as municipal and private healthcare service providers.</p> <p>Organizational interoperability is achieved through the coordination of work processes and by ensuring that other organizational issues make interaction is as efficient as possible. This includes business models and compliance to regulations.</p> <p>The focus needs to be on ownership of the overall processes rather than the ICT solutions.</p> <p><i>Semantic Interoperability</i> is the ability to interact based on common understanding of the information exchanged between parties in processes and ICT solutions. This requires common concepts as well as standards for information content and coding systems. International standards shall be used where they are available. The standards give requirements and guidance on the recording of both unstructured and structured information, so that this information has the same meaning for the various parties in the sector. Semantic interoperability also includes the description, and acceptance of the common conceptual framework for the communication between people.</p> <p>One of the pillars in enterprise architecture is a logical information model that spans across functional areas and disciplines in order to ensure common understanding of concepts and structures.</p> <p>If the need for new standards arises this shall be reported to the party in charge of standardization within the area in question. Common</p>

	<p>conceptual frameworks in areas where there is a need for common understanding, across disciplines, need to be established and widely accepted.</p> <p><i>Technical interoperability</i> is the ability of technical solutions to interact with each other. This requires that established technical standards are followed. Technical interoperability shall be ensured by following the current reference architectures within the sector. The reference architecture describes the technical standards and mechanisms for information exchange and sharing.</p>
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No	5
Name	Information Security
Principle	The enterprises shall ensure the quality, confidentiality, integrity, availability, and traceability of information.
Background	<p>Enterprise architecture shall make sure that all stakeholders (employees, patients, relatives and the public) have access to the information they need in an efficient, appropriate and secure way.</p> <p>Information security shall help to protect patient safety by</p> <ul style="list-style-type: none"> • securing patient information from unauthorized access, unauthorized alterations and loss of access for healthcare personnel while treating patients • ensuring non repudiation by signing • ensuring the traceability of actions • making sure that information is presented without risk of misinterpretations and misunderstandings <p>This shall ensure that the privacy and integrity of every patient is protected.</p> <p>Information security is also about protecting the privacy and integrity of the healthcare personnel by</p> <ul style="list-style-type: none"> • the protection of employees against unfair suspicion and accusations of abuse of information through the traceability of actions • the protection of employees against unfair suspicion and accusations of responsibility for incidents by ensuring non repudiation by signing
How to follow the principle	<p>The principle shall be followed by</p> <ul style="list-style-type: none"> • verifying that the 'Norm for information security' (<i>Norm for informasjonssikkerhet</i> is a Norwegian normative document) as well as other relevant laws and regulations are adhered to • providing access mechanisms that allow only legally authorized personnel to have access to health- and personal information • reviewing the control mechanisms for the protection of patient information, both with regard to its confidentiality, availability, integrity, traceability and quality • verifying that relevant events will be logged according to the applicable laws and regulations • making sure that the identity management, both for users inside of a business, between businesses, and for external users, is satisfactory for current uses

No	6
Name	Availability
Principle	All relevant user groups shall have access to necessary functionality and information, in the right form at the right time and in the right place.
Background	<p>Within healthcare the accessibility principle, when there is a legitimate need, shall ensure access to the functionality and information regardless of time and place.</p> <p>This principle deals with flexible service access in terms of time, place, and the medium (channel) at a high level. Services shall be available when needed, they shall be easy to find, and be available to the appropriate user groups.</p>
How to follow the principle	<p>The principle shall be followed by</p> <ul style="list-style-type: none"> • making sure that personnel have access to the services in accordance with their legal and professional requirements • designing functionality and information so that it is possible to deliver or provide access to relevant health information warranted in law • verifying that the services are robust, making sure that the consequences of lack of accessibility are considered and measures have been incorporated

No	7
Name	Quality of use
Principle	The ICT solutions of the enterprises shall be designed in a way that ensures effectiveness, efficiency and a good user experience.
Background	<p>A good user experience is achieved through high quality of use. High quality of use in an ICT-solution is characterised in that it is intuitive, effective, contains few errors, is fault tolerant, stable and motivating to use.</p> <p>A user friendly interface is important, but not sufficient. The solution must be easy to learn, and it must be easy to remember how to use it. ICT-solutions must be flexible and be able to be adapted to the different situations of use, with regard to efficient workflow, user categories, mobility, and the device being used.</p> <p>High quality of use is important if users are to find that an ICT solution supports their tasks.</p>
How to follow the principle	<p>The principle shall be followed by ensuring that</p> <ul style="list-style-type: none"> • established standards for quality of use are followed • the principles of universal design are to be followed (The Norwegian government's guidelines for "universell utforming") • users play a vital part in specifying needs and requirements • methods and principles for usability testing is followed • the user interface is adapted to the context of use, the user group, and the task to be performed

No	8
Name	Adaptability
Principle	The enterprises way of organization, their processes, ICT-solutions, information, and technology shall be designed in such a way that they can support changes, and not act as restrictions for change.
Background	<p>The specialist healthcare is in continuous change, as a result of changes in laws and regulations, technological innovations, new medical knowledge and enhancements in treatment s, as well as new ways of organizing work. Adaptability caters to the need to make changes quickly and efficiently and achieve lower life cycle costs for ICT-solutions.</p> <p>The principle is intended to assure that existing solutions are able to adapt to changes.</p> <p>Adaptability also includes scalability, i.e., the ability to meet new requirements in scope, range and volume. This applies to both scaling up and -down. Inability to scale can provide overload of services or needlessly high use of resources.</p>
How to follow the principle	<p>The principle shall be followed by</p> <ul style="list-style-type: none"> • designing solutions and services with the best possible flexibility and reuse • ensuring organizational adaptability by establishing routines and procedures for e.g. coordinated use of coding systems from national common components • ensuring that solutions are scalable both in the number of services, the number of users and the amount of information to be processed. • identify anticipated changes in capacity needs and plan accordingly

No	9
Name	Information Management
Principle	Information is a critical resource for the enterprises and shall be managed accordingly.
Background	Current, correct and complete information is the basis for efficient and effective processes, assessments and decisions. This is essential for the specialist healthcare's ability to deliver health care services of high quality, and to perform other mandated tasks. Information is to be treated as a critical resource in the enterprises, and must be managed for multiple uses.
How to follow the principle	<ul style="list-style-type: none"> • Information is managed in accordance with the internal and external requirements and guidelines. • Critical information objects in the enterprises shall have an information owner who is responsible for ensuring that the principles are being followed. • The owner must have the necessary authority and resources to manage the information for which they are responsible • Clear procedures for the management of information has to be established