Tender
5/10/2023

Procuring organization

Region Östergötland
Bernadett Brink

Procurement

RFI, Request for Information of openEHR platforms and related tools
RFI-2020-08:2
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Legend

- The text is included in the advert
- The text is included in the qualification
- The text will be part of the contract
- The text will be published in the contract catalogue
- The text/question contains requirements to be met
- ESPD The text/question contains ESPD requirements
- The question is weighted and included in the evaluation
- The question is weighted and included in the evaluation
- The question is asked for information only
- The question is answered by the buyer
- The question is marked for special follow-up
- The answer does not meet the requirement in the question
- Updated section or question

Tenderers

Supplier	Tender	Corporate ID	Qual.
DIPS ASA	DIPS Arena openEHR platform	979543883	

Contents

1. Invitation to openEHR RFI and demo

1.1 Invitation to openEHR RFI and demo

Sydöstra sjukvårdsregionen (including Region Östergötland, Region Kalmar län and Region Jönköpings län), Västra Götalandsregionen, Region Uppsala, Region Stockholm, and Region Skåne hereby invites suppliers of openEHR platforms and related tools (in this document called “Solution”) to a request for information and a product demonstration.

1.1.1 RFI process

This RFI process is divided into two (2) parts:

- The first part is open for all suppliers of openEHR solutions and consists of questions to be answered in written format, plus an appendix for context.
- The second part consists of an online product demonstration and is subject to specific qualification criteria. See Part 2: Demonstration sessions for details.

1.1.2 Date and time for demonstration sessions

The following time slots are available:

Date	Time (CEST/UTC+2)			
May 31	8:00-10:00 AM	10:00-12:00 AM	1:00-3:00 PM	3:00-5:00 PM
June 1	8:00-10:00 AM	10:00-12:00 AM	1:00-3:00 PM	3:00-5:00 PM
June 2	8:00-10:00 AM	10:00-12:00 AM	1:00-3:00 PM	3:00-5:00 PM

June 5 is reserved as an extra date for back-up purposes.

State which is your company’s preferred demo time slot, and also state all other time slots being acceptable alternatives.

Text field

Due to our annual customer conference, DIPS Forum May 31 - June 2, we would really like to do the demonstration on June 5.
The time slot on the day is:

- preferred 1:00 - 3:00 PM
- 10:00 - 12:00 AM

If not possible on June 5 we will try to make it on any other day at the same time slots.

1.1.3 Terms and definitions

Solution	The openEHR platform, related tools, and supporting applications that the RFI respondent can offer

RFI respondent	The part responding to the RFI
RFI document	This document
Application	A CDR external application integrated with the CDR, as part of - or not part of - the Solution.
CDR	Clinical Data Repository implementing the openEHR specifications
We	The group of county counsils issuing the RFI document
Request Context	All request metadata on the incoming HTTP request such as methods, headers, access tokens etc
Personal Data	The term ”personal data” is used throughout this document to describe every piece of information related to a specific patient kept by a healthcare organization.

1.1.4 No procurement

This is not a procurement. Please note that this does not constitute an RFP. Response to this invi

However, this is not bound to accept any of such information and/or expression of interest or to consider it further in any associated documents such as a RFP.

1.1.5 Confidentiality

During the RFI process, confidentiality prevails according to Chapter 19, Section 3 of the Public and Confidentiality Act (2009: 400).

Upon completion of the RFI, continued confidentiality may apply if there is reason to fear that a disclosure of information concerning the individual's business and operating conditions could cause harm to the individual. Furthermore, continued confidentiality may apply for the protection of the public interest.

When appealing decisions on confidentiality of information, RFI respondent shall assist the county councils and be responsible for their own costs arising from this.

In the event that the RFI respondent requests confidentiality, the RFI respondent must enclose documents describing the scope of the confidentiality and describe what damage the RFI respondent may suffer in the event of a publication. If the RFI respondent requests confidentiality, the RFI respondent must enclose a document specifying the parts of the RFI document for which the RFI respondent requests confidentiality and describe the damage the RFI respondent may suffer in the event of a publication.

a. Is privacy requested?
Yes/No

Answer

No

b. In those cases that the RFI respondent requests confidentiality, the RFI respondent must here attach what the privacy includes and describe which damage the bidder will suffer upon publication.

Attachment

0 attached documents

-

1.1.6 Questions about the request for information

All questions regarding the RFI must be asked via the VISMA TendSign RFI system, www.tendsign.com.

The wishes to receive questions in such a way that, together with the county counsils answer, they can be published without taking measures. The questions should therefore not contain information about the questioner's company, products or other information that can identify the questionnaire.

The county counsils want the RFI respondent to ask questions one at a time with reference to the point in the RFI document to which the question relates.

The county counsils answer the questions electronically in VISMA TendSign.

1.2 About this RFI

Region Östergötland, Västra Götalandsregionen, Region Uppsala, Region Stockholm, Region Skåne, and Region Kalmar (collectively referred to as “we” and “us” in this document) cover two thirds (⅔) of Sweden’s population. The majority of the county councils manage university hospitals with an extensive share of research and advanced healthcare. This RFI initiates the way forward, towards better healthcare and documentation solutions in Sweden.

This RFI aims at reaching all suppliers of openEHR solutions with an interest in the European market, in order to get an update on the latest news within the field. Doing this as a joint activity ensures higher quality results and is also timesaving for all parties.

The RFI may result in one or several procurements, either by each county council separately or by two or more county councils together. No decisions regarding possible joint procurements are taken yet and more county councils and organizations than these 5 may initiate procurements based on this RFI. Also note that all suppliers are welcome to take part in later coming procurements. There is no obligation to participate in the RFI and demo sessions, and participation does not affect later evaluation.

1.2.1 Facts about the County councils

The table shows some facts in figures about the county councils.

	Inhabitants (Total Swedish population is 10,5 million)	Hospitals	Health clinics	Dental care clinics	National specialized medical care assignments (46 different ones available)	Current main EHR system
Region Stockholm	2 440 027	5 (N/A)	Appr 600 (appr 1900)	Appr 80 (N/A)	36	CGM TakeCare

Region Uppsala	400 682	2 (3)	36 (58)	25 (80)	14	Cambio Cosmic
Region Östergötland	471 912	3 (3)	33 (47)	33 (109)	6	Cambio Cosmic
Region Skåne	1 414 324	9 (10)	100 (182)	69 (69)	25	Cerner Millenium
Västra Götalandsregionen	1 758 656	18 ()	117 ()	167 ()	29	Cerner Millenium
Region Kalmar län	247 711	3 (3)	26 (37)	18 (31)	N/A	Cambio Cosmic
Region Jönköpings län	369 184	3 (3)	28 (40)	26 (86)	N/A	Cambio Cosmic
Sum	7 102 496					

Population 2022 according to https://www.statistikdatabasen.scb.se/

National specialized medical care according to https://www.socialstyrelsen.se/en/clinical-practise-guidelines-and-regulations/regulations-and-guidelines/national-specialised-medical-care/.
Numbers within parenthesis () include collaborating private clinics etc.

1.2.2 Business impact goals

Three business impact goals of introducing openEHR-based healthcare systems are:

- Faster adaptation of IT systems to the constantly changing needs of the healthcare clinicians, including a more efficient system development process
- Increased control of stored health record data and increased reuse of information structures within and between applications, and between caregivers
- Increased freedom of action for the regions when the data is stored in a vendor neutral and open format

1.2.3 Purpose

The Swedish county councils are in the process of establishing an infrastructure for information management and information governance based on an information strategy and its target architecture. A key component of this infrastructure is to be able to store healthcare related information in a standardized and application neutral way.

The interoperability solution is an addition to existing healthcare information systems. A subset of the patients' medical records must be possible to handle in the CDR component both as master record as well as copies. We need a standardized reference model for how the information and data is structured and implemented in the CDR. Each application that renders information should have the ability to select, and customize its information stored in the CDR, in accordance with the reference model.

An example where this CDR capability would be relevant, is when an independent health app is used, but is not part of the main healthcare information system. In the long term, the CDR component will also be used for other applications of healthcare related information. Another early application will be remote/home monitoring.

Other secondary uses of interest are: patient created data, biobank data, healthcare business development, BI, AI, CDR, research, and quality registries.

2. Part 1: Questions

2.1 Questions

Answer the questions in this section in writing. Answer the questions that are relevant to your Solution. Not all questions in this RFI need to be answered, but the majority needs to be answered in order for you to be invited to the demonstration.

The supplier must enter all answers in the system.

The supplier may not attach documents.

2.1.1 General

a. What is the name and intended purpose of your Solution? Please name and (very briefly) describe the openEHR-related tools and platform components that you may be referring to in other parts of your RFI response.

Text field

DIPS has since 2012 invested in openEHR as a core part of our hospital information system DIPS Arena. DIPS Arena is third generation software for the hospitals in Norway and it was developed to support new needs in health care. Needs like process and decision support based on structured clinical data. We chose openEHR as the formalism for clinical modelling and data management. Over the years we have developed the openEHR CDR, tooling, components and platform based on needs from our customers and ongoing projects. The main focus for our development, so far, has been to support internal needs. Still all openEHR tools and software are developed to be standalone. They can be used outside of DIPS Arena.

For the RFI process we will provide the following components and tools which might be needed for your openEHR plans in Sweden:

EHR Store
The openEHR CDR providing an openEHR REST API. Supports AQL, Compositions, Forms, etc.

ETL Service
A service which takes annotated AQL and combine those with demographic metadata to extract, transform and load data into datawarehouses. This is the latest component in our openEHR suite and it is second generation openEHR ETL service in DIPS.
* Form Designer A low code form builder over openEHR operational templates.
* Form Renderer Components to render forms defined with Form Designer. Two renderers are implemented: one in WPF and one for Web. The web based renderer is used in DIPS Mobile, DIPS Wall and also in our ongoing project to support patient entered data.
* VAQM A formalism to define structured and reusable AQL queries. It also support formatting and decision support over the resultset. VAQM is a key component for reuse of data into our clinical applications. It’s in many components to display key data, trends or within patientlists.
* EHR Craft Studio Our integrated development tool used when developing forms, vaqms, aql and other resources in our tooling platform. EHR Craft Studio might be the most used code in DIPS since it is used daily by a lot of product developers.
* openEHR SDK All components use the same SW library to process openEHR resources – this go all the way from the CDR to tooling and forms.

b. In which country is your company located? Are there any sales partners or support partners in Sweden or Swedish speaking staff? Can your Solution or parts of it, e.g. additional services or license packs, be delivered via existing national Swedish framework agreements (see https://www.avropa.se/topplankar/In-English/).

Text field

DIPS is based in Norway. We speek Norwegian (of course) and English when needed. As you know Norwegians understand Swedish well.

Currently no connection to any Swedish partners or framework agreements.

c. Describe the overall architecture of your Solution.

Text field

See attached document.

d. Describe if/how openEHR's Task Planning functionality (or other process support) is supported by your Solution now, and your future roadmap for such support.

Text field

DIPS implemented a protype of a Task Planning service in 2017. It was a functional backend capable of importing task plans and execute them. Further work on this was postpone. Currently DIPS does not have openEHR Task planning on the road map.

e. Describe if/how the Solution supports development and use of clinical decision support (CDS), for example using openEHR's GDL or GDL2 specifications now, and your future roadmap for such support.

Text field

DIPS implemented GDL as part of EHR Store and planned to integrate it with DIPS Arena. During the implementation we found a need to integrate the execution with the patient administrative context (demographics). We started the implementation of VAQM and more advanced Forms to support the needs for CDS in DIPS Arena. GDL is not part of the roadmap.

2.1.2 Delivery models

a. List the delivery/deployment models you support, such as local installation (OnPrem) or cloud installation (for instance SaaS)?

Text field

We currently deliver the software on premise.

b. Describe, in the case of SaaS deployments, your subcontractor structure used to deliver the service. List any hyperscalar public cloud services used and the jurisdiction they operate in with relation to the EU/GDPR and transfer of personal data.

Text field

N/A

c. If you are dependent on third-party suppliers in your solution proposal, how do you package this with an overall responsibility regarding usability, licenses and support?

Text field

No third-party suppliers needed.

d. Can applications based on output from your products be published as open source? If so, are there any restrictions on usage? This implies e.g. that generated code, forms, configuration information etc. and exported runtime components should be perpetually allowed to be included in open source based systems and in associated, possibly public, versioning systems (like GitHub).

Text field

The tooling is delivered using two models:

* Integrated license to be used within the organization with the license to use the tool.
* Full license where the license holder has full ownership of the output from the products.

e. Describe how your product can be installed using containers and container orchestration tools such as Kubernetes.

Text field

The software can be delivered as containers and installed in Kubernetes as a Helm Chart with Helm.

f. Describe your approach to scaling your Solution. Describe known limitations, for instance regarding performance.

Text field

* Horizontal scaling in Kubernetes
* No known limitations. In current deployments the performance of the CDR is not the bottleneck for performance.

g. Briefly describe your three (3) largest or most interesting customer installations based on an openEHR CDR. Also describe how long it took to go from purchase to operational system with real patient data and actual use.

Text field

The three largest customer installations are:

* Oslo University Hospital (start 2014) with an ongoing deployment into the region – Helse Sør Øst.
* Helse Vest
* Helse Nord

Our use of openEHR is integrated with DIPS Arena. The timeline is mostly dependent of the customers project to upgrade to DIPS Arena and start using the new capabilities with a structured EHR based on openEHR. Today we deliver cooperative projects with customers. We have the capability to implement, deploy and run new applications within our from idea to production. Real projects lead by clinicians will use weeks. Most of the time spent is on the clinical modelling and process related design.

h. Describe what kind of infrastructure your Solution requires from a customer. Also describe your normal implementation/deployment process.

Text field

Requirements:

* Kubernetes
* Oracle (Oracle is used in production in Norway. We also support MS SQL Server and other RDBMS when needed)
* Apache Solr
* Redis

Deployment:
Containers and helm-charts are published in DIPS Artifacts HUB (https://artifacthub.dips.no/). ArgoCD used for automation.

i. Describe your software lifecycle strategy and release cadence.

Text field

Minor Releases: Minor releases could occur every four to six weeks and would include bug fixes and small feature updates. These updates could be deployed to a staging environment for further testing before being released to production.

Major Releases: Major releases could occur every six to twelve months and would include more significant feature updates and improvements. These updates would go through a more rigorous testing process before being released to production.

Maintenance Releases: Maintenance releases could occur on an as-needed basis to address critical bugs or security issues that arise between major releases.

j. Describe your future roadmap. What major features are planned and when are they planned to be released?

Text field

The road map is always adjusted to customer needs. There are currently major features planned for the roadmap. Current features in openEHR as used in DIPS Arena is good enough. Most of the work has been and is on integrating openEHR into the whole system – DIPS Arena, and also in the tooling and the Form capabilities.

2.1.3 Legal and regulatory aspects

Please refer to background information in appendix “OpenEHR – an Implementors Guideline related to Swedish laws and regulations in healthcare”. It also reflects our level of ambition, and discusses some different possible openEHR-based solutions. Please feel free to be inspired by this document; we also look forward to receiving alternative solutions and discussions. We refer to COMPOSITIONs below to make the text more readable but we are actually interested in corresponding behavior regarding all relevant VERSIONED_OBJECTs (for example FOLDERs).

2.1.3.1 Multi-tenancy, Federation and Metadata

a. Describe how the Solution can be configured to support multi-tenancy where clinical data for hundreds of organizations (care providers/care units) can be managed efficiently.

Text field

This kind of need is supported by DIPS Arena which takes care for the demographics and access control. The openEHR CDR just carry the metadata to enable this.

b. Describe how the Solution can be configured in a fine-grained multi-tenant model (see Appendix A) so that a COMPOSITION and/or parts of a COMPOSITION within an EHR record can be attributed organizational ownership. Also describe how and where this metadata can be persisted.

Text field

In addition to attributes from openEHR RM we have implemented a system for TAG on COMPOSITION level. This is a key/value structure to add loosely coupled metadata on openEHR data. This system was developed to be able to add attributes from the integrated system. Using TAG we can integrate data from DIPS Arena (or any other legacy system) which are not versioned.

c. Describe how metadata about organizational ownership/multi-tenancy, and about source (e.g. originating/feeder-system), can be verified/validated against the Request Context and/or external attribute sources to make sure that the proposed metadata is valid and that the user has sufficient permissions to write/modify data for this unit.

Text field

This is not part of the openEHR CDR (EHR Store). This kind of features are implemented in DIPS Arena.

2.1.3.2 Querying and Multi-tenancy

a. Describe how (see Appendix A) the Solution can be configured to filter a response from the EHR API resource endpoints based on metadata from the Request Context, external attribute source and/or metadata on the COMPOSITION itself (such as validated metadata for organizational ownership).

Text field

Handled by DIPS Arena using structured queries with metadata for demographics. The calling client defines the scope for the query using a POST request. Scopes used in production are PATIENT, HOSPITAL, DEPARTMENT, SECTION, EPISODE_OF_CARE, PERIOD_OF_CARE and FOLDER. In addition the calling client might add scopes for different groups and types of EHR documents.

b. Describe how (see Appendix A) the Solution can be configured to block or filter out parts of a RESULT_SET from the Query Execute API resource endpoints based on metadata from the Request Context, external attribute source and/or metadata on the COMPOSITION itself, such as validated metadata for organizational ownership. (Example of possible solution: Incoming ad-hoc queries and/or stored queries may be temporarily modified to support the filtering.)

Text field

Handled by DIPS Arena using either pre-filter based on functional or data elements in applications or post-filter based on access control on compositions/documents. This is the same feature set as described above (2.1.3.2-a)

c. Describe if and how (a possibly extended set of) the openEHR Reference Model can be used to block or filter out parts of a RESULT_SET from the Query Execute API resource endpoints based on metadata from the Request Context, and/or external attribute sources. Describe at least support for using the following classes for blocking/filtering data

i. FOLDERs

ii. TAGsF

iii. EEDER_AUDIT

Text field

Same as above – handled by DIPS Arena using EHR Store filtering data with either TAGS or FOLDERS.
FEEDER_AUDIT is supported by the CDR for query and filter. We've not been using it in production.

d. Describe how the Solution can be configured to block and/or allow requests to resource endpoints from the ITS-REST specification based on metadata from the Request Context and/or external attribute sources.

Text field

Such features are taken care of by the access-control in DIPS Arena.

2.1.3.3 Bulk Operations

a. Describe any tooling and/or APIs available for managing bulk operations on COMPOSITIONs. Describe how the target set of COMPOSITIONs (bundle/batch) can be defined from a result of an AQL query.

Text field

We have no such tools/function - to do bulk operations on COMPOSITIONS based on AQL queries.

b. Describe any tooling and/or APIs available for managing bulk import operations of COMPOSITIONs. Describe how metadata on COMPOSITIONs are validated/verified.

Text field

We do bulk import of COMPOSITIONS from the source system (DIPS Arena) into the CDR. For best performance this is done by a asynchronous transactional database function to transfer and re-index data.

2.1.3.4 Audit Logging

a. Describe the set of triggers (instrumentation) the Solution can use for audit logging. What is logged and when?

Text field

The formal audit log for the EHR is handled by DIPS Arena.

b. Describe how the Solution can be configured to export audit logs and/or integrated to external SIEM systems. Also describe and/or list the supported technical interfaces.

Text field

The formal audit log for the EHR is handled by DIPS Arena.

2.1.3.5 Certification of products, tools and modules

a. Are any of your openEHR products, tools or modules certified (CE labeled) according to EU Medical Device Directive 93/42/EEC or the EU Medical Devices Regulation (MDR)? If yes, please state which product or module that fulfills which regulation.

Text field

N/A

b. Describe your experience of the process to CE label a software as a medical device?
Text field

N/A

2.1.3.6 Accessibility

Describe how the Solution supports (or helps creating) end user interfaces in accordance with the European accessibility directive European accessibility act - Employment, Social Affairs & Inclusion - European Commission (europa.eu).
Text field

N/A

2.1.4 Platform and development

a. What parts of the Solution are open source and what parts are proprietary? Describe what open source license you use.
Text field

Currently the software is developed as a closed-source solution to be used internally in DIPS. We have plans to open-source large parts of the software. Doing this will require some efforts and we have not yet seen the need of doing this.

b. Describe any prebuilt products or EHR-modules based on the platform that you can provide, for instance end-user applications for surgery, emergency wards, medications, or primary care. Also describe any provided “portal” functionality or similar that can easily be configured to different use cases where e.g. clinical end users can browse, read and enter openEHR-based data. Also briefly describe the pricing model for these.
Text field

We have currently not planned for any prebuilt products or end-user (clinical) applications.

c. Describe your integration support, tooling and experience, including but not limited to the list items i-vii below. Clearly indicate which list item the answer refers to.

i) Software development kits (SDK:s) for developing and integrating towards your API:s etc.

ii) Publish/subscribe patterns

iii) HL7 FHIR

iv) API standards (such as HL7 v2, IHE, ODBC, OpenAPI) and other interoperability and connectivity standards

v) Integrations with medical imaging standards such as DICOM

vi) OMOP and other standards used for research

vii) Existing EHR systems in Sweden (if so, please state which)

Text field

DIPS has long experience in integrating openEHR with an existing EHR system. The hardest part of implementing openEHR in DIPS was to integrate it. This is both on the technical domain, but even more on the organizational and cultural domain. Currently openEHR is part of the whole system and it is used as the CDR for all clinical data not present in other parts of the system. Being an EHR vendor for ¾ of the hospitals in Norway we have developed lots of integration over the years.

Our experience is that openEHR is an enabler. The hardest part is actually defining the API. Since the rest of the health care system is not openEHR they must work out the API specifications and make sure other systems implement them. This takes time.

d. Describe how an external terminology server can be connected to the Solution and used both for term selection in forms/GUI and for validation of incoming COMPOSITIONs via API.What terminology server standards or products have been successfully tested and used with the Solution?

Text field

External terminology server is used for form based input. DIPS Arena has an integrated terminology database and provides a DIPS API which is used.

Currently the CDR does not validate the terminology used in the COMPOSITION. The validation is taken care of by components in DIPS Arena.

e. Describe if/how the openEHR demographic model specification is supported by your Solution now, and your future roadmap for such support.

Text field

We have no used openEHR demographic model in production. We have implemented openEHR democraphics RM in the openEHR SDK.

So far we've not seen the need for it since demographic are handled by DIPS Arena and we have found a way to integrate the demographic with openEHR CDR.

f. Describe query mechanisms in your Solution. Clearly indicate which list item the answer refers to.

i) Describe what version of the AQL specification the CDR supports and if something from the specification is not yet supported.

ii) What parts of the RM can be reached and used as selectors and filters in queries in addition to more "normal" COMPOSITION content? For example, how can FEEDER_AUDIT, LINK, FOLDER (including the FOLDER.details ITEM_STRUCTURE) and TAGs be used to select and filter content through AQL syntax (extensions) and/or via context information like API call parameters?

Text field

i) We are compliant with the latest specification of AQL and we share new ideas/concepts with the specification group in openEHR.
ii) All parts of the RM are possible to query. We do not follow LINK in AQL or support demographics with AQL.
We support using TAGS in both select and where-clauses.

g. Describe if and how you support use of openEHR's TAG and FOLDER classes and mechanisms, including for what API endpoints (such as …/composition and …/query) they can be used to for example show/hide data based on if data belongs to certain FOLDERs (or it's subfolders) or not, or based on the presence or absence of certain TAG keys and TAG values.

Text field

DIPS share all our ideas and implementations of AQL. Folders has been suggested here: https://github.com/DIPSAS/openehr-conformance/tree/master/aql/case2-folders

TAGS here: https://openehr.atlassian.net/wiki/spaces/spec/pages/424706234/Current+State+of+Data+Tagging+Overview

2.1.5 Tools

a. Does the Solution provide integrated version control tool support (for example Git/Github integrations) for easy retrieval and storage of assets, such as archetypes, templates, forms, and queries? If yes, please describe it briefly.

Text field

DIPS has developed a complete pipeline from atomic resources (i.e. archetypes) to complete applications to be developed. We call it “distributed development of clinical applications”. The idea is to be able to develop clinical applications in a larger ecosystem. Developers from the vendor should be able to cooperate with the customer to develop, configure, deploy and run the applications. This is why we choose openEHR in the beginning.

Today we have developed a system for “package management” which packages and build applications. They are published on a NuGet feed for internal/external testing and installation/deployment to production.

b. Describe how/if your products include tool support, and how well they comply with specifications, for openEHR archetype/template lifecycle management and related form lifecycle management.

Text field

We do not provide tools for archetype/template edit and governance. The governance of such is done as part of the national CKM – arketyper.no.

c. Describe how your Solution supports multilingual openEHR models in data and end user interfaces. How do you provide workarounds for OPT 1.4 multilingual limitations? Describe if tool-interfaces are multilingual and can be translated and localized to Swedish.

Text field

We currently deploy our solution for customers in Norway. Still the tooling is developed to be multilingual and support multiple languages. The limitations in OPT 1.4 is there and we have, currently, not investigated workarounds.

The use-interfaces of the tooling is written in English and translated into Norwegian. Swedish translation will be possible.

d. To what extent do you support combining your Solution with components from other openEHR vendors? Describe successful tests you have done regarding this.

Text field

We use the available tooling for archetypes and templates. The output from them is integrated with our tooling platform. There are no other components integrated in our deployments in Norway.

e. Describe how/if your Solution includes tool support for (ad-hoc and stored) AQL management and use, and how well they comply with (and possibly extend) specifications, for instance the examples in the list items i-iv below. Clearly indicate which list item the answer refers to.

i) Nested and/or joined AQL queries

ii) Development and testing of variables in parametric queries

iii)AQL tools and environments for authoring queries, presentation, export and visualization of AQL responses

iv) Built in configurable/programmable pre- and/or post-processing of queries and results (server and/or client side)

Text field

AQL is the base for all query solutions used within DIPS applications. We support the specification, both the AQL specification and the REST API with parametric queries.

i) We use nested AQL queries in DIPS openEHR ETL Service. This is needed to be able to transform data into a more report/analytical friendly format.
ii) We have implemented support for parametric queries. Still these are not widely used in production applications.
iii) EHR Craft Studio and EHR Store both has an embedded testbench for development, execution and presentation of result sets. VAQM is our tool/solution to manage structured queries, presentation and formatting for visualisation. This is widely used in DIPS Arena for decision support (alerts when values are high, etc.) , key data widgets and also in timeline graphs.

iv) N/A

f. Describe how/if your Solution includes tool support for templates, and how well it complies with specifications for the examples in the list items i-iii below. Clearly indicate which list item the answer refers to.

i) Support for nested/embedded templates

ii) What template tools that have been tested and found compatible with your Solution

iii) Support for templates based on ADL 2

Text field

i) We do not provide template editing tools
ii) We support templates for Better archetype editor (tools.openehr.org) and Oceans Template designer
iii) No support

g. Describe how/if your Solution includes tool support for the examples in the list items i-v below. Clearly indicate which list item the answer refers to.

i) Developing GUI:s

ii) Data management

iii) Import, export, and migration of data, metadata and system configuration, in open well documented formats.

iv) SMART on FHIR integration

v) Mapping and conversion support other standards such as HL7/FHIR

Text field

i)
DIPS Form Designer is a low-code tool to develop forms.
In DIPS Arena there are multiple components to provide user interfaces like keydata widgets, timelines, patientlists with openEHR data. Most of these components are driven by VAQM definitions.

ii) N/A
iii) N/A
iv)
We have some SMART on FHIR activities which uses EHR Store (openEHR as a backend for data). Still this is experimental and not used in production.
In addition to this we have also experimented with SMART applications directly over EHR Store (openEHR CDR). We call it Smart on openEHR.

v)
We have some integration services which uses openEHR SDK to do the mapping. We investigated and prototyped a configurable mapping solution using handlebars. This was rejected since it was to hard to develop and maintain. Latest integration with HL7/FHIR does coded integration with openEHR and using the SDK. This makes (unit) testing of the mapping simpler and the integration easier to maintain.

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h. Describe how/if your Solution includes tool support for creation and use of entry forms based on openEHR templates. Clearly indicate which list item i-ii the answer refers to.

i) Which form rendering tools have been tested and found compatible with your CDR/platform?

ii) Do you supply a form builder and renderer? If yes, please briefly describe its features, for instance drag-n-drop, smart pictures (allowing annotations, term binding, graphs), low code/no code, conditional expressions.

Text field

i)
We have developed our own rendering tools supporting multiple end-user devices. The form renderer is used in our mobile (“in-pocket”), patient portal (“web”), wall based solutions (“web”) and desktop (“WPF”).

ii)
DIPS Form Designer is our form builder tool. This is a low-/no-code tool to create user-interfaces using drag and drop from templates. For more advanced domain-logic we provide both an embedded calc-engine and javascript API .
We have two form renderers based on the form definitions. One written for WEB and the other (first implemented) for .NET/WPF.

Over the years there have been much work on the form capabilities. Today there is a rich set of features which makes it possible to build smaller clinical applications using the form renderer tooling.

i. Describe how/if your products include tool support, and how well they comply with any open specifications, for log management, such as alarms and access logs.
Text field

Log management and access logs are part of DIPS Arena.

2.1.6 IT and Information Security

a. Describe what kind of IT security features are implemented in your Solution, for instance support for securing API, data at rest, data in transport, data in operation, data removal, and logging and audit.
Text field

EHR Store are deployed “behind” DIPS Arena which takes care of these features.

b. State if there are any relevant IT security certifications for your Solution, such as ISO27001, ISO27018.
Text field

N/A - part of DIPS Arena.

c. Describe what kinds of authentication, authorization and access methods your Solution supports, for instance external IDP, role-based access control, privileged users control, just-in-time access.
Text field

Authentication, authorization, and access control is delegated to DIPS Arena which has lots of functionality in this area. DIPS Arena is authenticated and authorized as a super-user to the CDR.
The following content gives a summary of the architecture:

The openEHR CDR is exposed as a REST based web service. Traditional authentication and security types for REST based endpoint will be supported.

Still there are a few challenges to be solved.

Authorization and privacy assurance is complex within health and care. There are different laws and regulations from country to country. DIPS has experience from Norway where the laws and regulations for EHR are stronger than GDPR in many areas.
One example is that a patient can restrict a specific document for a specific user. Such requirements need a complex authorization solution with quite a detailed view. DIPS chose not to delegate this functionality into the openEHR CDR. In our setup the CDR can be seen as a database where the inner application layer has root access. Thus, we have strong authentication and security for the client (the application server) calling the openEHR CDR. The access control and authorization are then delegated to the application service layer.

d. Do you use supply chain risk management strategies/tools, such as SBOM? Describe how you mitigate risks associated with development, maintenance, acquisitions and, sunsetting of systems/components and/or services? How are risks and mitigating actions documented and what is your strategy for enforcing compliance?

Text field

Currently shared with DIPS Arena installation and delivery.

2.1.7 Training, documentation and consultant services

a. Describe the availability of course or on-line training for administrators, technicians, tool users, software developers, EHR end-users (if you provide modules/products for end-users).

Text field

We do online-sessions with customers both for support, training, advisory and other needs. We've found it best for both vendor and customer to make this driven by demand.

b. Describe which kind of product documentation you provide, for instance user manuals, installation guides, system administration guides.

Text field

User documentation, installation guide, system administration, embedded documentation on the tooling.

c. Do you offer consultant services for implementation, configuration and/or development?

Text field

Yes. We have a very active consultant department providing such services. They provide different kind of services related to the development of clinical applications based on openEHR. We do both practical work for the customers (installation, configuration, development, clinical modelling, etc.) and we also do a lot of advisory. The advisory part is about learning the customers to be self-driven on some parts for the development process.

3. Part 2: Demonstration

3.1 Demonstration sessions

The second part of this RFI consists of a demonstration session where selected respondents, that meet the qualification criteria described below, are invited to demo their Solution.

3.1.1 Qualification and prioritization criteria

To be qualified for a demo time you will need to demonstrate a Solution that is helpful when creating applications, capturing or storing clinical data based on openEHR standards, that is, not just general integration or CDR products. If there is competition for available presentation/demo slots, the written responses to above listed questions will be used as prioritization criteria.

A maximum of six (6) suppliers will get an invite to a demo session.

3.1.2 Purpose

The purpose of the demo is to show how your Solution meets the needs of the stated target groups and the user stories described below.

3.1.3 Dates

The demo sessions are held on May 31, June 1 and June 2. June 5 is reserved as an extra date for back-up purposes. Each demo is limited to two (2) hours.

3.1.4 Format

The demo is an online two (2) hour session via Zoom. The sessions are recorded and made public on Youtube when all suppliers have held their sessions.The purpose of publication is to help other organizations interested in openEHR systems.

A demo session is on the following format:

- Short introduction of company and Solution and what is going to be presented in the demo (maximum 2 minutes)
- Demo based on target group descriptions and user stories
- Discussion with questions and answers (minimum 30 minutes)
- Optionally and on request, the recording can be stopped for the last 15 minutes of the discussion, if there are parts that should not be made publicly available.

Additional county councils may later join the RFI and attend the demonstrations as listeners.

3.1.5 Instructions

To reach business impact goals and purposes, it is essential that a procured solution meets the needs and expectations of the different target groups that will use the openEHR Solution. A number of essential target groups are identified – Platform administrator/technician, Application and content developer/administrator, Super user, External actor, Application end-user, and Newbie.

Each target group has a description and some of them have one or several user stories that highlight aspects of the target group that we think would be interesting for a demo. Use these descriptions and user stories as a basis for your demo. You are not expected to demo everything.

During the demo session, please refer to which target groups/user stories you are demonstrating.

3.1.6 Application and Content Developer/Administrator

This is an informatician, a software developer or a system/content manager. She develops applications, builds integrations, does information modeling and form building, and designs queries for information retrieval. She is also responsible for maintenance of applications, information structures and content. She gives technical support and help to other users of the openEHR tools. When functions that are more complicated are needed in an openEHR-based application, the application and content developer/administrator takes care of it. She is an advanced user with high demands on smart functions in the development tools.

User stories based on Application and content developer/administrator:

1. As an informatician I want to connect an external terminology service to make sure that the terms within the data are consistent with appropriate terminology standards and valuesets/subsets.
2. As a healthcare system developer I want to integrate software to be able to store and retrieve medical data in an openEHR EHR system alongside other healthcare system vendors.

3. As a healthcare developer working on a SmartOnFhir application I want to be able to access part of the openEHR information as standard FHIR API.

4. As an administrator or developer I want to configure or be able to create solutions for collecting IoT device measurements from patients. This includes

   a) data from medical devices that we as healthcare providers have provided, support and collect data from.

   b) data from patients' privately purchased devices (smartwatches, blood pressure meters etc) that they may have connected to apps in their Android and iOS devices - this transfer may be initiated by the patient without being actively requested by healthcare (e.g. before a visit). Such data should when stored be possible to identify as patient reported so that it can be logically separated from other data.

   c) where the data was created and by which person and device.

5. As an administrator or developer I want to configure or be able to create solutions for collecting data from patient-reported forms, photos, and videos.

6. As an administrator I want to be able to referens see Appendix A

   a) create/define metadata attributes to personal data so the Solution can be configured to meet our needs.

   b) add/update metadata for a specific piece of personal data.

   c) add/update metadata to personal data as a bulk update, e.g. for all compositions created at a certain organizational unit.

   d) use metadata to create functions managing what information a user has access to e.g. in an overview of an encounter of a patient who received specialist care.

3.1.7 Platform Administrator/Technician

This person works in the IT department, has a technical education and a few years working experience. It is his job to ensure that the platform and the development tools are sound and up and running. The platform administrator/technician is an advanced user that needs powerful tools for administration of the openEHR platform. He wants to have full control and overview, and efficient configuration and error handling and system diagnostics tools. The openEHR platform is not his only responsibility at work; there are many other systems as well, so he values extensive system documentation. Sometimes he needs support, and he is grateful that he gets it quickly.

User stories based on Platform administrator/technician:

1. As a server-admin, I want to use supporting functions so that I can carry out technical troubleshooting.

2. As a first line support tech, I want to view the system's operational status via web-UI so that I can at a glance check if there are any issues.

3. As an administrator I want to manage access-rights, e.g. configuring rules, roles and access control policies, so that I can restrict access to information based on user context and information attributes.

3.1.8 Super user

The super user is a nurse, a physician or a researcher at a healthcare unit and is interested in how new technical solutions can be used to improve the patient care, working processes, and gaining new medical knowledge. The super user maintains existing forms and templates in the openEHR-based applications that the department uses. The super user really prefers to be able to solve problems himself if possible. But in rare cases it gets a bit too complicated, for instance when programming skills are necessary or when a new template is needed, and then the super user contacts application and content developer/administrator for help and they cooperate on the solution. The super user also generates reports from the healthcare systems that the care department needs; often it is standard reports that are generated repeatedly, but sometimes a special report is needed.

The super user does not use the openEHR tools on a daily basis, but is more of a "burst" user where intense use is combined with periods of little use or no use at all. This pattern of use means that he might not ever be fluent in how to use the tools.

Since the super user does not have deep technical knowledge it is important that the tools he uses to update forms and templates are easy to use. It is also important for the super user that it is easy to get an overview of which templates and forms that the clinic is using, that version handling is easy and straightforward, and that efficient search and filtering tools are available. The super user also needs a comprehensible report generation tool.

User stories based on Super user:

1. As a clinician, I want to build and design a dynamic form, based on existing templates, with conditional form field display logic and automatic calculations, for structured documentation.

2. As a researcher, I want to create reusable methods to search, collect and present data, for example regarding a certain patient group/diagnosis and only for a specific gender at a certain age.

3. As a clinician, I want to design and generate ad hoc reports, from data collected through a form.

4. As a new employee (or occasional “burst” user) I need user friendly, and intuitive easy to use tools and graphical user interfaces.

3.1.9 Application End-User

Application end-user is a healthcare clinician or a citizen. He wants to enter and retrieve information from and to the health record system. The application end-user has no interest in the technical aspects of the applications they use; the important thing is that the applications support what they want to do in a smooth way. This may include that the applications are always available, or that only information that is relevant in the particular context is shown. In some situations, it may be of interest for the application end-user to switch language in an application. Since he could be any citizen, it might be the case that he has some kind of disability, for instance impaired vision, and is in need of things like enlarged text or textual descriptions of images. Thus, his needs concern the results of using the openEHR platform and development tools; as long as the resulting applications are stable

and good, he is happy.

User stories based on Application end-user:

1. As a clinician, I want to have a Clinical Decision Support and process support functionality, to improve the quality of care and reduce risks.

3.1.10 External Actor

External actor is a company, a student, another healthcare region, or a researcher. The external actor delivers applications or content. The external actor has no direct access to the internal systems and uses her own development tools. It is important for her that a full range of REST APIs is available, and she values extensive system documentation. It could be convenient for her to use openEHR tool licenses for a limited period when developing on behalf of a healthcare region.

3.1.11 Newbie

The Newbie is a nurse or a physician at a hospital, but may also be an informatician or a software developer. Newbie has a few years working experience but no or little knowledge of openEHR. Now is the first time Newbie takes part in maintaining existing forms and templates or in developing a new openEHR-based solution. It is important for the Newbie that the tools for developing forms are easy to learn and that the user documentation is pedagogical and covers all common use cases and functions. Some kind of introductory training to get started would help Newbie a lot.