



Response to
RFI 2018-63 openEHR

1. Introduction

Ripple Foundation are pleased to have the opportunity to respond to this request for information to Region Östergötland, in support of their openEHR back-end implementation ambitions.

An open platform based approach is an exciting and innovative initiative for Region Östergötland and demonstrates the strong clinical and business leadership in the region towards truly integrated health and care/government.

Given the pressures health and care systems are under, it is acknowledged that major changes in the way care is delivered are necessary to achieve a sustainable model of healthcare in the 21st century. While the shift in this direction is non trivial, this phased/controlled approach towards an open platform in healthcare, to be undertaken can be best understood as a smart step towards a new digital health and care system.

2. Overview

Ripple Foundation was established in 2016 as a not for profit Community Interest Company with the objective of supporting the adoption of an [open platform](#) for health and care. As part of its mission, the Ripple Foundation has commissioned the development of 3 leading open source components to positively disrupt the health and care IT market, aimed at great usability, ease of integration and vendor & technology neutral data persistence. The ambition of the Foundation is to grow an effective marketplace of services around these 3 components of both clinical, business and technical services.

3 Company information

3.1 General		Answer:
3.1.1	Company name	Ripple Foundation C.I.C Ltd
3.1.2	Company main office location	Kemp House 152 City Road London EC1V 2NX UK
3.1.3	Company location in Sweden (cities)	Not applicable
3.1.4	Number of employees (total)	2 core, plus 5 consultants
3.1.5	Number of employees in Sweden	0
3.1.6	Web address to company product site	http://ripple.foundation

3.2 Contact		Answer:
3.2.1	Name of sales contact	Phil Barrett
3.2.2	E-mail of sales contact	phil.barrett@ripple.foundation
3.2.3	Phone number of sales contact	+ 44 203 2399113
3.2.4	Name of technical contact	Dr Tony Shannon
3.2.5	E-mail of technical	tony.shannon@ripple.foundation
3.2.6	Phone number of technical contact	+ 353 1 254 8113

3.3 Partner		Answer:
3.3.1	Does the company have any sales partners in Sweden? (Y(names)/N)	No

4	Product information	
4.1 General		Answer:
4.1.1	Name of product?	<p>Ripple Foundation are supporting the development of three leading open source components to positively disrupt the current Health IT marketplace that form our showcase stack, namely:</p> <p>UX/UI Framework for EPR/EMR/Regional and Personal record needs called PulseTile http://pulsetile.com</p> <p>An integration, messaging and queuing framework called QEWD.JS http://qewdjs.com</p> <p>Clinical Data Repository compliant with the openEHR standard called EtherCIS http://ethercis.org</p> <p>These are separate components, cognisant of the existing landscape in healthcare IT, to meet the varying and complex needs of people across the globe and aligned with a bi-model approach advocated by Gartner.</p> <p>We have analysed and developed against the complexity of the NHS health IT landscape and developed a maturity model that explains how our approach & stack can take healthcare organisations from a non openEHR landscape to an openEHR based platform in a staged approach. http://ripple.foundation/2016/02/integrated-care-digital-records-maturity-model/</p>
4.1.2	Current version of product?	EtherCIS 1.1 (as the openEHR CDR element is the primary focus of the RFI)
4.1.3	Number/size of installations?	<p>0</p> <p>The first go live implementation is due this year, to deliver a Person Held Record for the city of Leeds, England, where the Ripple stack including EtherCIS is being deployed. See related story here; https://www.digitalhealth.net/2017/10/leeds-develops-person-held-record-locals/</p>

4.1.4	Describe the product update strategy (ex. number of major/minor update/year)	Quarterly minor releases as per published roadmap https://github.com/ethercis/ethercis/blob/master/ethercis-roadmap.md
4.2 Support		Answer:
4.2.1	Availability of support? (24/7, 8/5 or other)	Ripple Foundation as a not for profit is supporting the international adoption of an open platform and change in the marketplace towards a service orientated market in health IT based on a leading set of open source components. We are actively welcoming and seeking partners (commercial / non commercial) to grow this market and provide related services support. We are able to provide 3rd line support for EtherCIS on a 8/5 basis.
4.2.3	Availability of on-site installation support? (Free or billed)	As per 4.2.1, we are an international non profit organisation, primarily working remotely. Again we actively seek local partners for on site work.
4.2.4	Availability of Health (best practice) checks?	We provide leadership, strategy and quality assurance services as part of our non profit organisation services.
4.3 Licensing		Answer:
4.3.1	Describe the license model for the product (CPU, user, other)	Provided on an Apache 2.0 licence https://www.apache.org/licenses/LICENSE-2.0
4.3.2	Does the license model have options for setting up development and QA-environments (not for real patient care) that differs from production environment licenses?	Yes
4.3.3	Describe support agreement alternatives for the product	To be determined based on the project requirements (see 4.2.1)

4.4 Procurement & pricing		Answer:
4.4.1	Is the product offered through Swedish public sector framework agreements ("Kammarollegiet" procurement contract) (e.g. via an existing Swedish partner)	Not currently
4.4.2	If possible, please provide approximate price examples for some scenarios. Are there alternative price models regarding initial and recurring costs?	Pricing for scenarios based on the information available would very much be a guesstimate, so suggest we defer responding to this point at this time.
4.4.3	How does your business model provide compensation if promised functions (e.g. like described in 5.1.7) would be specified in a contract but would not be available in time as promised?	We are a non profit foundation working with SMEs to deliver these open source goods into the market place, based on a services model (no software license fees etc), so our current business model does not have that feature. You are welcome to suggest ones that may fit with an open source business model..

5		Functional requirements
5.1 Basic framework		Answer:
5.1.1	What parts of the the openEHR Reference Model Specification are fully implemented, and according what version of the specification?	<ul style="list-style-type: none"> • EHR • COMMON • DATA STRUCTURE • DATA TYPES • SUPPORT • INTEGRATION ADL1.4 OPT1.4 (based on Ocean's TD format for the latter)
5.1.2	What parts of the the openEHR REST API	<ul style="list-style-type: none"> • EHR • EHR STATUS

	<p>Specification are fully implemented? What formats (e.g. JSON and XML) are supported? Are any other (non standard) REST APIs implemented?</p>	<ul style="list-style-type: none"> ● COMPOSITION ● VERSIONED_COMPOSITION ● CONTRIBUTION (internal at the moment, but could be exposed if needed) ● Query <p>Currently supports Marand's FLAT JSON, EtherCIS Flat JSON, Canonical XML, Canonical JSON in output (input is planned for Q3 2018).</p> <p>Non standard capabilities</p> <ul style="list-style-type: none"> ● Template management (load/retrieve) ● Template Introspection ● SQL querying ● EHR object linking (n-to-m relationship) ● Triggers
5.1.3	<p>Is the openEHR Archetype Query Language specification (at least version 1.0, Trial Draft) fully implemented? Are there any additional capabilities, e.g. full text search, FOLDER-based filtering etc?</p>	<p>Yes AQL is supported</p> <p>Full text search will be supported (f.e. Medical notes in compositions) by Q3 2018 (underlying logic is there, needs to be exposed).</p> <p>Support multiple functions (statistics, string, provision for user defined functions)</p>
5.1.4	<p>How is validation of EHR content done based on RM, archetypes and templates by the system? What types and versions of template-mechansims are used for validation?</p>	<p>The validation is based on the constraints defined in the OPT 1.4. Each commit operation (create/update) is subject to input validation.</p>
5.1.5	<p>Is GDL (Guideline Definition Language) (at least version 1.0, TRIAL DRAFT) supported? Are any other clinical decision support mechanisms available?</p>	<p>GDL is not part of EtherCIS.</p> <p>There is a connector operational with Medexter's ArdenSuite CDS.</p>
5.1.6	<p>What parts of the new "TaskPlanning Model Specification" are implemented?</p>	<p>None</p>
5.1.7	<p>What parts in the 5.1.x questions above that are not</p>	<p>If needed, 5.1.6 can be implemented for Q3 2018.</p>

	implemented right now will be available in September 2018?	
5.1.8	Describe available terminology service usage/integrations. Is the terminology service addressable from AQL queries? Is there a FHIR Terminology Service interface?	Not at this time. The HighMed consortium from Germany under the leadership of Birger Haarbrandt are investing in a team of developers to add this type of functionality to EtherCIS as part of their multihospital research plan, which could be leveraged.

5.2 Tests & performance		Answer:
5.2.1	Please provide information and results from AQL query performance tests done for the product. (Have you for example run any of the "ORBDA" example tests?)	We welcome the publishing of the ORBDA paper. We have not had the opportunity fund this performance test work to date. Within the context of one of our main projects, the Leeds PHR (as referenced earlier), we have planned to to test EtherCIS against the ORBDA dataset.
5.2.2	Please provide information regarding other performance tests done or normal loads in significant real installations	Performance testing is on our roadmap as we move to implementation at scale, we hope the ORBDA dataset will help with this.
5.2.3	The test cases/scripts in chapter 6 ("Conformance Schedule") of the "openEHR EHR Platform Conformance" document are not finished, but when looking at the list of test descriptions, are there any of the listed capabilities your system has not yet implemented in some api-accessible form?	Our view is EtherCIS supports the majority of the capabilities in the Platform Conformance schedule, although we have not documented its conformance to date . Due to time and resource constraints, we have not been able to furnish this aspect of the RFI analysis in detail at this time, but would be able to do so upon request, if given adequate notice.

5.3 Tooling & configuration		Answer:
5.3.1	Does the product contain an application development environment that enables applications, registries etc. to be built on the repository using openEHR data. Please describe.	<p>EtherCIS is the powerful open source openEHR based Clinical Data Repository within the Ripple Showcase stack of open source technologies.</p> <p>Alongside it, QEWDjs is a leading nodeJS based environment to support application building including our own ;</p> <p>PulseTile UX/UI framework (which includes PHR, EPR and Integrated Care Record functionality, is intended as a base application environment for a wide range of application, registry building etc), as per these videos. https://www.youtube.com/watch?v=JAudRFpexCo&index=1&list=PLNxHSK29ViKLrrhdPTqbYr6XGTya4uGBv https://www.youtube.com/watch?v=jpfIZ_HWr3w&list=PLNxHSK29ViKLrrhdPTqbYr6XGTya4uGBv&index=2</p>
5.3.2	Is there a graphical drag and drop form generator (or similar functionality) available that makes it easy to create HTML5-based data entry forms (including client side validation and basic constraint checking) based on openEHR templates.	<p>We have done and are doing a lot of interesting work in this area.</p> <p>The main challenge we see the adoption of an open source stack based on openEHR is the steep learning curve for regular developers to be able to leverage this technology.</p> <p>So our open platform work is tiered into 3 key open source layers - PulseTile (UX/UI framework) QEWDjs (Integration framework) EtherCIS (Clinical Data Repository based on openEHR)</p> <p>While EtherCIS primarily role is an openEHR based CDR we are using QEWDjs to process an openEHR template by name alone and that then processes the template to automate the generation of UI and FHIR side JSON</p> <p>See this openEHR Jumper technology video here to get a sense as to the related JSON mapping tooling within https://www.youtube.com/watch?v=iaGGGgJdWvM&list=PLNxHSK29ViKLrrhdPTqbYr6XGTya4uGBv&index=5</p> <p>That in turn is hooked into our UI framework, which importantly is independent of the integration & openEHR CDR elements, allowing us to create linkage from openEHR templates to UI elements with a JSON mapping tool. https://jsfiddle.net/tshannon/hgypL94d/</p>

		We now need to automate some of that to make it even easier to use.
5.3.3	Is there a function to render compositions as human-readable documents (resolving at/id-codes and hiding “technical” attributes)	Not available at this time. Under consideration for the EtherCIS roadmap
5.3.4	Is an easy to use (e.g. drag-and-drop?) query editor available to create AQL queries based on Archetypes and Templates?	Not available at this time. Under consideration for the EtherCIS roadmap.
5.3.5	Are functions like domains or namespaces available to achieve a logical separation of data between different care organisations using a physically shared server instance?	There are different way to deploy to support this feature. What is really important to remember is that ONE database is logically partitioned (it's a Postgresql feature) per tenant with multiple EtherCIS instances (potentially using different namespace as discussed below) are serving client requests according to the tenancy they belong to.

6 Non-functional requirements

6.1	Infrastructure	Answer:
6.1.1	List supported OS	Linux, Windows 7+
6.1.2	Support for cluster configuration (describe)	<p>Based on 2 levels clustering:</p> <ol style="list-style-type: none"> 1. Server cluster <ol style="list-style-type: none"> a. Multiple EtherCIS instances are addressed via a load balancer (EtherCIS is session-less using JWT, see below) b. Server instances could be specialized further if integrated into a container orchestration framework 2. Database cluster <ol style="list-style-type: none"> a. Based on Master-Master or Master-Slave behind active connection pools (https://wiki.postgresql.org/wiki/Replication,_Clustering,_and_Connection_Pooling) <p>NB. The DB supports sharding and logical partitioning using schema. EtherCIS is schema aware (allowing multi-tenancy).</p>
6.1.3	List supported DBMS	PostgreSQL 10+
6.1.4	Support of management packs for Microsoft System Center	<p>EtherCIS supports JMX class instrumentation (and most services will be instrumented by Q3 2018) and SCOM supports Java process monitoring. There are also some provision to monitor PostgreSQL server in SCOM.</p>
6.1.5	Describe minimum hardware requirements for a test installation	<p>Very dependent on the number of users/db size/frequency of queries etc. Can be as low as a single host with 32GB RAM, 2 quad core CPU, 500 GB (SSD). Preference is 2 hosts: one for EtherCIS instances and one for the DB.</p>
6.1.6	Limitations on using Virtualization (hardware/laaS)?	<p>No limitations for EtherCIS server tier. On the DB side, it all depends again on the requirements. Since the hardware is an abstraction, there is indeed very limited possibilities to tune the host/hardware with DB processing. Hardware/kernel/DB tuning is desirable whenever high TPS throughput is expected.</p>

6.2	Security	Answer:
6.2.1	Support of role based authorization? Describe (default/typical) roles	Yes (Q2 2018). Based on Apache Shiro (https://shiro.apache.org/authorization.html).
6.2.2	Support of authentication tickets issued by an Identity Provider (e.g, SAML)?	JWT f.e. Auth0
6.2.3	Support of logging; access and change?	Logging occurs for all access to the REST API (specialized audit service). Application level logging is also available and configurable at runtime via JMX

6.3	Training	Answer:
6.3.1	Availability of course or on-line training for administrators? Describe	EtherCIS (as well as other key components PulseTile & QEWDjs) are all documented online, for continual improvement, dependent on additional resources. We would welcome the commissioning of rich free online and open source training materials into the commons, by an interested party.
6.3.2	Availability of course or on-line training for technicians? Describe	See 6.3.1
6.3.3	Availability of course or on-line training for users? Describe	See 6.3.1

6.4	Usage	Answer:
6.4.1	Is the number of registered users limited, if so what is the limit?	No limit, this is open source software
6.4.2	Is the number of simultaneous users limited, if so what is the limit?	No theoretical limit (e.g. by license), obviously dependent on resources (hardware spec etc)
6.4.3	Is the number of managed assets limited, if so what is the limit?	No theoretical limit (e.g. by license), obviously dependent on resources (hardware spec etc)
6.4.4	Does the license model allow usage for research as well as caregiving?	Yes
6.4.5	Does the software product provide client libraries to support the	The QEWDjs component in the Ripple showcase stack is a Javascript/nodeJS based technology that supports

	development of software against the system, if so in what program languages?	application building on EtherCIS. The EtherCIS component is Java based technology. No resource for other libraries at this point.
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6.5 Management		Answer:
6.5.1	Is it possible to export system configuration between different instances of the installation? If so how?	EtherCIS configuration is fully contained in an /etc directory. The configuration can be shared, duplicated between several instances.
6.5.2	Is it possible to run multiple instances of the installation on the same network without conflicts? If so how?	Yes. Each server instance must bind to separate IP port numbers (on the same host) or different IP address. NB multi-homed configuration is a supported.
6.5.3	Is it possible to run different versions of the same system simultaneously within the same instance?	Yes. The actual configuration could be based on versions allocated to different namespaces with a HTTP router dispatching the queries to the matching service instance (in case of version differentiated on service capabilities). There are many variations of this approach depending on the use case.
6.5.4	Does the software allow soft launches of new versions?	<p>EtherCIS server instance can be configured with different service capabilities (f.e. AQL, EHR, Template etc.). Instances are dockerized and can be orchestrated according to the requirements.</p> <p>Since EtherCIS is a middleware tier that interface a database (clusterized or not), all kind of topologies can be planned (the same apply to 6.5.1, 6.5.2. And 6.5.3).</p>

6.6 Integrations		Answer:
6.6.1	Does the software product have an interface to support import/export of HL7v2 messages?	<p>EtherCIS has been developed in conjunction with other powerful open source components for these purposes. In particular the QEWDjs based framework we support can import/export HL7v2 messages as part of its work as a powerful yet flexible integration framework.</p> <p>See here http://qewdjs.com/ https://github.com/robtweed/qewd-transform-json-editor</p>
6.6.2	Does the software product have an interface to support import/export of HL7 FHIR messages?	<p>EtherCIS has been developed in conjunction with other powerful open source components for these purposes.</p> <p>In particular the QEWDjs based framework has been developed to support the easy mapping between openEHR & FHIR resources as part of its work as a powerful yet flexible integration framework.</p> <p>See here http://qewdjs.com/ Please see these videos to see this in action. https://www.youtube.com/watch?v=kW30ighTk94&list=PLNxHSK29ViKLrrhdPTqbYr6XGTya4uGBv&index=4&t=0s https://www.youtube.com/watch?v=iaGGGgJdWvM&list=PLNxHSK29ViKLrrhdPTqbYr6XGTya4uGBv&index=5</p>
6.6.3	Does the system support automated extraction of required IHE XDS.b data from openEHR compositions?	<p>Not at this time. The HighMed consortium from Germany under the leadership of Birger Haarbrandt are investing in a team of developers to add this type of functionality to EtherCIS as part of their multihospital research plan, which could be leveraged.</p>
6.6.4	Does the system support extraction, mapping and storage of required DICOM metadata from KOS Objects to openEHR compositions	<p>The Ripple open source stack, including PulseTile and QEWDjs offers support for DICOM images with a demonstrable showcase of a DICOM viewer within the application framework. https://youtu.be/jpflZ_HWr3w?list=PLNxHSK29ViKLrrhdPTqbYr6XGTya4uGBv&t=49 This work has been done in conjunction with the Orthanc DICOM Server. https://www.orthanc-server.com/</p>

		<p>This UI side Tiles are available in both Angular and React versions, see related documentation:</p> <p>http://docs.pulsetile.com/react-webRTC.html http://docs.pulsetile.com/angular-webRTC.html</p> <p>We expect further work on the metadata aspect to be done in conjunction with the IHE work as per 6.6.3</p>
6.6.5	Describe other integration support features of the platform.	<p>PulseTile UX/UI framework is driven by a set of RESTful JSON APIs</p> <p>QEWDjs offers an integration framework that can handle UI, FHIR , openEHR system integration, as well as integration with a diverse range of tools through the 600,000 modules from the npm ecosystem, the world's largest software registry. https://www.npmjs.com/</p> <p>EtherCIS offers a range of integration at DB level, in particular FDW (foreign data wrappers), materialized views (OLAP), fast data input, trigger based computation. Support of AQL Demographics querying (with demographic db wrapped in a FDW) is planned for Q3-Q4 2018.</p>

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