# openEHR Technical Course

Welcome to study the openEHR Technical Course!

The course has been prepared in co-operation between Rosaldo Oy and Dr Sidharth Ramesh. Sidharth has been responsible for preparing the Course material and he is also acting as the facilitator in the course. He is the Founder and CEO of Medblocks offering eHealth systems development, consultancy and training especially in the fields of openEHR and HL7 FHIR.
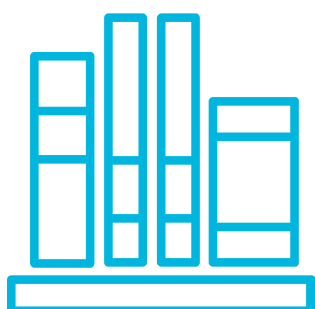
If you study this Course together with a team, active communication with the other participants as well as with the facilitator is encouraged during the study. Chatting, commenting and asking questions will help you digest and analyze the topics from several viewpoints. If you study this Course alone, you have the chance to address your comments and questions to the facilitator.

You can also receive a certificate for completion of the Course.

The Course will familiarize you with the core technical elements of openEHR and the openEHR architecture, where data is separated from the applications. During the Course you will gain hands-on experience on setting up EHRbase, understanding REST APIs, and building forms with free and open-source tools such as Archetype Designer, EHRbase CDR, openEHR SDK, and Medblocks UI. You'll start with the basics, such as multi-level modeling and the Clinical Knowledge Manager, and progress to advanced topics like AQLs and application development.

You will be equipped with the skills to excel in the implementation of openEHR. You'll also learn about practical considerations, including integration challenges and best practices for using openEHR in real-world scenarios.

TRAINING CONTENT

The training is structured as follows:

The Course is composed of 6 sections:

Section 1 Introduction to openEHR gives you a strong understanding of openEHR and its core concepts and unique features.

Section 2 Get Up and Running with openEHR - FAST builds your knowledge of openEHR's technical environment through hands-on tutorials.

Section 3 Diving Deeper into openEHR gives you deeper knowledge on openEHR data formats and guides you to using Web Templates for generating openEHR compositions. Furthermore, you will be guided into the world of AQL queries.
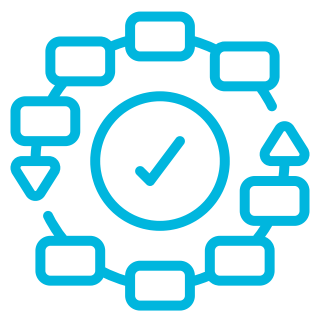
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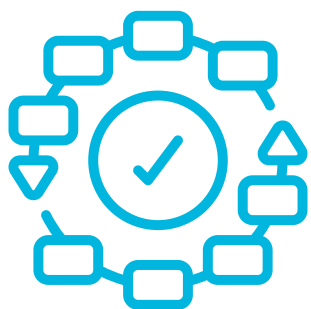
Section 4 Building applications with openEHR – Diving Deeper tells you about the essential principles of building applications on openEHR, but will also help you build applications using Medblocks UI Tools on EHRbase CDR.

Section 5 Practical considerations when using openEHR shares with you some practical learnings that your facilitator gained while developing openEHR-based applications.

Section 6 Conclusion recaps the learnings and guides you to your journey with openEHR.

Section 1: Introduction to openEHR
This section is composed of the following modules:
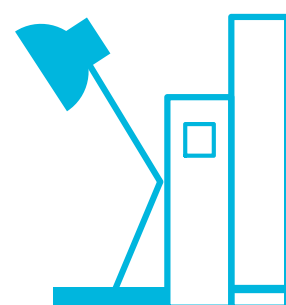
Who am I
This module introduces your facilitator Dr Sidharth Ramesh.

Prerequisites
This module outlines the prerequisites necessary for the participants to effectively engage with the course content.

Monoliths, Microservices, and the Data Platform
This module explores the evolution from monolithic architectures to microservices and describes how openEHR fits into this paradigm.

### Reference Model, Archetypes, and Templates
This module explains openEHR's core concepts: Reference Model, Archetypes, and Templates. You get an in-depth look at how openEHR facilitates data interoperability and expressivity in healthcare applications.

The openEHR Clinical Knowledge Manager (CKM) and Discourse
This module provides an overview of key aspects of the openEHR framework, emphasizing the importance of two main resources: the Clinical Knowledge Manager (CKM) and the openEHR community. We teach you about the openEHR CKM, its purpose, and how it facilitates clinical knowledge sharing. We are also guiding you to take practical steps to join the openEHR community and to stay updated with discussions and advancements using Discourse.

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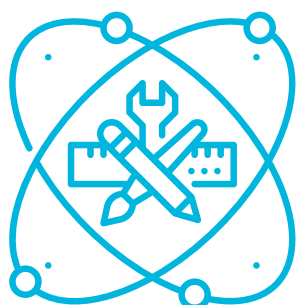
## Section 2: Get Up and Running with openEHR -FAST

This section is composed of the following modules:

Get up and running with openEHR - Fast

In this module we explain the structure and the study process for this section.

System set-up and prerequisites

In this module we guide you to set up a development environment for working with openEHR with the focus in securing that you have the necessary software tools and comply with the prerequisites. Our target is to prepare the participants of the Course to be able to interact with REST APIs and to manage openEHR servers effectively.
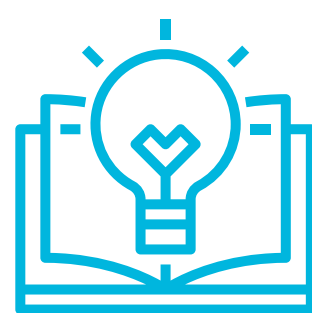
Setting up EHRbase Using Docker Compose

In this module you get a hands-on tutorial for setting up an open-source version of EHRbase, a health records management system based on openEHR standards. The session is designed as a foundational setup for upcoming modules in the course, which will leverage EHRbase extensively.

Introduction to the openEHR REST API – Template, EHR and Composition

In this module we provide an intuitive overview of key concepts in the openEHR framework, specifically focusing on templates, electronic health records (EHR), and compositions. In this module we enhance understanding of the foundational concepts, which are crucial for further exploration and practical applications in openEHR.

Creating a Template Using the Archetype Designer – Part 1

In this module you get a step-by-step guide on setting up and using the openEHR Archetype Designer for creating and managing health data templates.

Creating a Template Using the Archetype Designer – Part 2

In this module you get a step-by-step guide on creating a template using multiple archetypes within the openEHR framework. We also outline the process of prohibiting optional elements to identify mandatory ones, managing occurrences for data capture, and exporting the final template as an Operational Template (OPT).

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Setting Up Postman & the Course Collection

In this module you are guided to prepare your environment to interact with openEHR REST APIs using Postman. We provide a step-by-step guide on setting up Postman to interact with EHRbase APIs for the openEHR course module. The tutorial ensures that users can successfully test their connection to guarantee the setup is correct.

Template API

In this module you learn to interact with the Template API for managing Templates programmatically. You get a practical introduction to using the openEHR REST API, focusing on setting up the environment and interacting with the API using Postman.

Composition API – Example Composition API

In this module we give you an overview of creating and managing data instances in an openEHR system using various composition formats. We teach how to generate and persist data for vital signs using different JSON and XML structures.
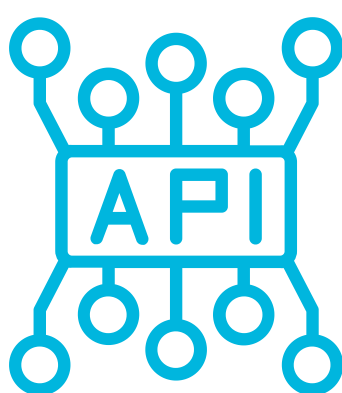
Composition API – Create Composition Canonical JSON

In this module we provide you with a step-by-step guide on creating and submitting a composition in an openEHR system using the EHRBase server commit.

Composition API – Create FLAT JSON

In this module we show how to work with the FLAT JSON format in the context of openEHR compositions. You are taught how to use Postman to post this data into your EHRbase server.

Composition API – Retrieving the Composition

This module focuses on retrieving openEHR compositions using various serialization formats, demonstrating how to efficiently query and access data from the openEHR system. It builds on previous knowledge of creating compositions with canonical and flat JSON formats. The process of obtaining data using a versioned composition ID is explained, and the flexibility of retrieving the data in different formats, such as Canonical XML, Canonical JSON, and FLAT formats, is highlighted.

Composition API – Updating a Composition

In this module we provide you with a step-by-step guide on updating a composition in openEHR using the REST API. You learn about the importance of using the correct versioned Composition ID for updates and we demonstrate updating Compositions in different formats such as XML and JSON.

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Composition API – Retrieving a Particular Version of a Composition

In this module we provide a tutorial on how to retrieve specific versions of a Composition using openEHR. It explains the process of accessing different versions of a Composition by utilizing version IDs and shows how to navigate through the history of changes made to a particular Composition.

AQLs Introduction

In this module you get an introduction to Archetype Query Language (AQL) used in openEHR systems. We explain how AQL allows users to query Compositions without knowing the specific Composition IDs, thus enabling more dynamic and powerful data retrieval.

Query API –AQL on multiple Templates

In this module you get comprehensive guidance on using AQL within the openEHR framework to query data. We demonstrate the process of creating a patient summary template, focusing on integrating health metrics like blood pressure, pulse rate, and body mass index.
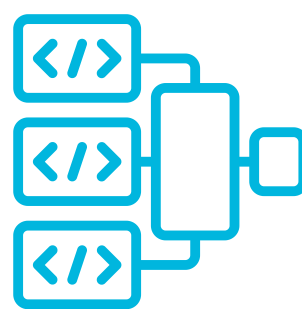
AQL WHERE Clause Filtering by Template & EHR

In this module you learn about practical querying techniques using AQL within openEHR systems. The focus is on efficiently retrieving specific data by filtering compositions and EHRs. You will get step-by-step guidance on applying AQL filters to narrow down results based on templates and EHR IDs.

Composition API – Deleting a Composition

In this module you learn how to delete a composition in openEHR using a versioned composition ID. We explain the process of utilizing the composition delete endpoint to perform the deletion.

Checkpoint – Iterate and Fail

When reaching this point, you have learned 80 % of what you would use in practice with the openEHR REST API. Now you will be encouraged to apply your knowledge, experiment, and even break things in your development environment in order to learn how to use openEHR through iteration and failure.

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Section 3: Diving Deeper into openEHR

This section is composed of the following modules:

Diving Deeper into openEHR Rest API

This module is the introductory module to the section. We explain about the section delving deeper into the openEHR REST API, building upon earlier basic interactions by exploring more advanced functionalities. The focus is on understanding the openEHR REST API specification and how it relates to the Postman collection included with the course, specifically examining the use of headers and endpoints.

EHRs with Subject IDs

In this module our focus is on a specific API related to Electronic Health Records (EHR) within the openEHR framework, emphasizing the creation and management of EHRs using subject IDs.

Creating a Composition by hand (Canonical JSON)

In this module you are taught how to manually create RM objects using canonical JSON derived from OPT XML. The session is a comprehensive guide to manually constructing a valid composition object to post to an openEHR REST API.

Creating a FLAT Composition by hand

In this module you learn about FLAT formats for openEHR compositions. The session walks through the process of using web templates to manage and structure compositions.

Structured JSON Compositions

In this module you learn about STRUCTURED formats for openEHR compositions. We explore the differences and similarities between creating FLAT and structured JSON compositions within the openEHR framework.

Context Auto-Population in Simplified Format

This module guides you into the practical use of the CTX attribute in openEHR compositions.

AQL Query Parameters

In this module we delve into the Advanced Query Language (AQL) used within the openEHR framework. Our focus is on the implementation of query parameters to enhance AQL queries.
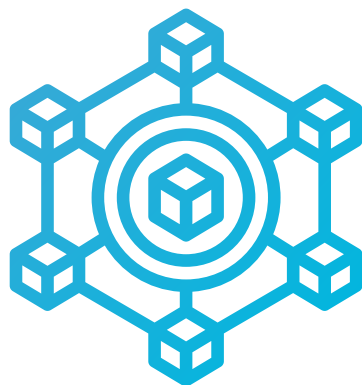
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Stored AQLs

In this module you learn how to save and manage reusable AQL queries using the AQLs API. We explain the benefits of storing queries in the openEHR system, allowing for repeated execution without the need to rewrite complex AQL statements each time.

Understanding AQL Clauses

This module focuses on understanding the structure of AQL queries, breaking them down into their fundamental parts, and providing insights into their application. We use the AQL documentation from EHRbase as a reference point, providing a practical guide to get started with various types of AQL queries.

AQL FROM … CONTAINS Clause

This module teaches you about the 'FROM' and 'CONTAINS' clauses. It provides insights into how these clauses allow users to selectively extract various components from an openEHR Clinical Data Repository (CDR), such as Compositions, observations, clusters, and elements.

AQL SELECT Clause

In this module we focus on demonstrating the use of the 'SELECT' statement in AQL for querying specific data from openEHR Compositions.

AQL WHERE Clause

In this module we teach about the `WHERE`clause in AQL. You learn how to use it used filter and refine query results within openEHR systems.

AQL ORDER BY, OFFSET & LIMIT Clauses

In this module we concentrate on the practical use of the 'ORDER BY', 'OFFSET' and 'LIMIT' clauses in AQL, which are essential for sorting and paginating query results in openEHR.

Directory API & FOLDERS

In this module you learn about organizing and managing data hierarchically using the Directory API. The focus is on understanding and utilizing the directory API and folder features within the openEHR systems.

Contribution API

This module gives you understanding on how to manage changes and audit trails using the Contributions API. We explain how contributions are automatically generated when using general composition endpoints and highlight their importance in maintaining a consistent state across the system

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Section 4: Building Applications with openEHR - Diving Deeper

This section is composed of the following modules:

Introduction to Building Apps on openEHR

This module teaches you about the essential principles of building applications in openEHR. The focus on the tools and techniques required to develop applications on top of openEHR.
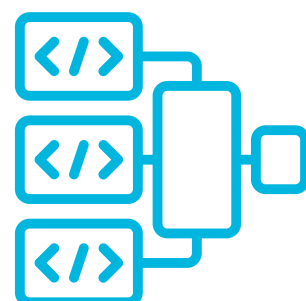
Building a Simple openEHR Based Form

In this module you learn about simple HTML forms to post health data compositions to an openEHR endpoint. We demonstrate using HTML, CSS, and JavaScript to create a form for submitting vital signs data such as pulse rate and blood pressure.

Creating a Composition with Medblocks UI

In this module you use Medblocks UI to generate compositions for straightforward templates.

Importing a Composition into Medblocks UI Form

In this module you get to explore the functionality of the Medblocks UI autoform, specifically focusing on importing data back into the form.

Customizing Medblocks UI Forms

In this module we teach you on customizing forms in Medblocks UI. You start by rendering a form automatically via a web template and learn how to customize the capabilities Medblocks UI.

Using the openEHR SDK

In this module you leverage the EHRbase SDK to programmatically create compositions. You will learn how to set up a client configuration, retrieve templates, and create and post compositions using the openEHR standards.

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Section 5: Practical Considerations When Using openEHR

This section is composed of the following modules:
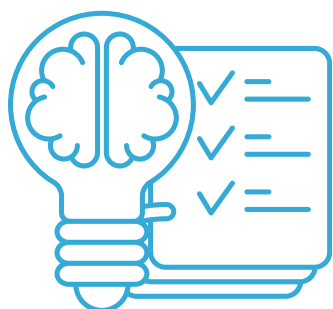
Practical Tips and considerations

In this module we shift the focus from technical theory to practical application, addressing real-life challenges you may encounter while building applications using various tools.

Don't Dual Write

In this module we discuss the challenges and solutions related to handling data consistency between openEHR servers and traditional databases. Our focus is on the 'dual write problem,' where writing data separately to both an openEHR server and a database can lead to inconsistencies if one operation fails.

When NOT to use openEHR

In this module we focus on evaluating when it is economically viable to implement openEHR, considering the upfront costs and long-term benefits.

Anonymity & Differential Privacy

In this module we explore privacy concerns in healthcare data and how openEHR systems address (or don't address) privacy by default.

Using & Contributing to Open-Source

In this module we discuss open-source tools in the context of health IT. The importance of community contribution to improve the quality and reliability of open-source health IT tools is highlighted. We also advise some strategies for using these tools in production environments.

Section 6: Conclusion

In this section we recap the learnings and guide you to your journey with openEHR.

Summary & Key Take Aways

In this module we recap the learnings from the Course and you will discover how to continue your journey with openEHR.

Conclusions & possible next steps

In this module we explain about the openEHR Bootcamp available at medblocks.com, which is a hands-on learning experience by guiding participants through the development of five complex real-world applications.

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