DOME 4.0

Deliverable D6.6 - Education Training Model, Webinar & Training Material

Responsible Partner:	EPFL	11 November 2024
Contributor(s):	Roberto Bendinelli, Nicola Marzari (INTRA)	21 November 2024
Reviewer(s):	Treesa Rose Joseph (SINTEF), Nikos Chondrogiannis (INTRA)	28 November 2024
Coordinator:	CMCL Innovations	29 November 2024
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V1.1	29 Nov 2024	Amit Bhave	Final review
V1.2	29 Nov 2024	Willem van Dorp	Finalization

Publishable Summary

This deliverable presents the education and training model developed for the DOME 4.0 project, with a specific focus on training materials for the Lhumos platform, a key component integrated into the DOME 4.0 ecosystem. It covers the overall training approach as well as concrete examples of training content.

Executive Summary

Education and training play a crucial role in helping DOME 4.0 reach its full potential, supporting stakeholders in effectively using the industrial data marketplace. To achieve this, the project developed a training model that includes online documentation, webinars, and workshops. Lhumos was chosen as the main platform to organize and share the training materials created during the project, making it easy for users to access essential resources.

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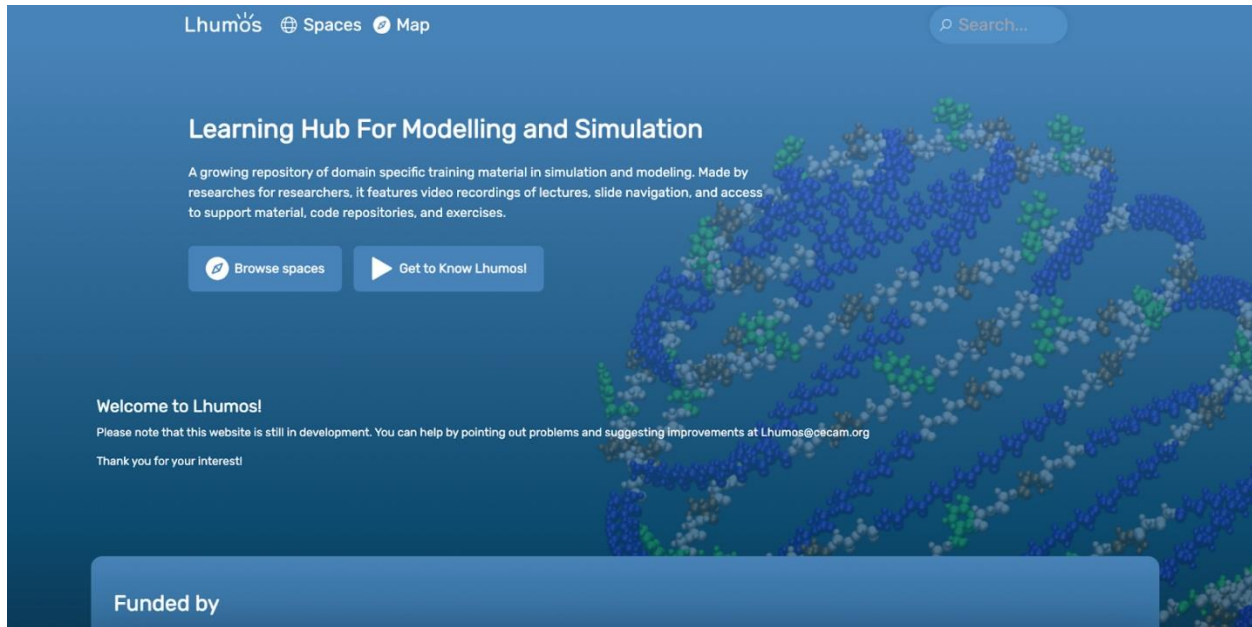
1. Introduction

Figure 1: Lhumos home page

The Lhumos platform was the center of the efforts in order to provide an open-source e-learning solution for the DOME 4.0 ecosystem. Lhumos serves as the primary hub for training content, hosting everything from technical documentation to interactive tutorials. Its scalable architecture and seamless integration allow for an efficient delivery of educational resources.

This deliverable outlines the education model and provides an in-depth look at how Lhumos supports DOME 4.0 training objectives.
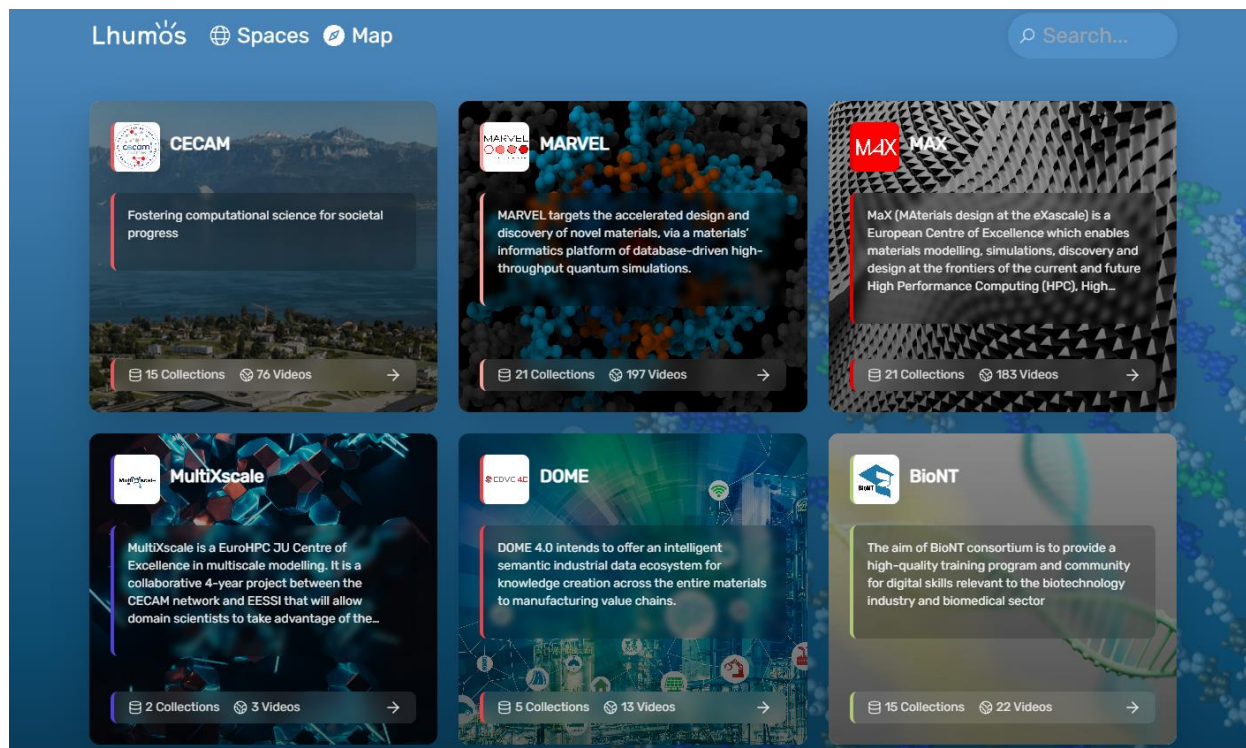
2. Lhumos Platform Overview

Figure 2: Dome space within the Lhumos ecosystem

Lhumos is an innovative e-learning platform designed for the materials science community. Its goal is to provide useful learning tools to students, scientists, and industrial users in high-performance computing (HPC) applications. The platform aggregates educational resources such as videos, lectures, codes, tutorials, seminars, and exercises. These cover a wide range of topics, including electronic structure calculations, molecular dynamics, HPC techniques, code optimization, and more.

4.1 The Lhumos training model

The Lhumos training model leverages automated metadata extraction to create a rich, interconnected learning environment. When content like video lectures is uploaded, the system automatically extracts slide content, generates timestamps. This metadata is combined with attached resources (PDFs, URLs, ZIP files) that provide supplementary materials synchronized with the video content.

The platform enhances learning through:

- Synchronized slide navigation that automatically updates based on video timestamps

- Interactive playlists that organize content into coherent learning sequences

- Shared files accessible across entire collections, providing context and additional resources

- Multi-format content delivery combining video lectures, slides, and downloadable materials

For example, during video playback, learners can click on extracted slides to jump to relevant sections, while simultaneously accessing related documents and resources. This integration of automated metadata with diverse content formats creates an engaging, self-paced learning experience.
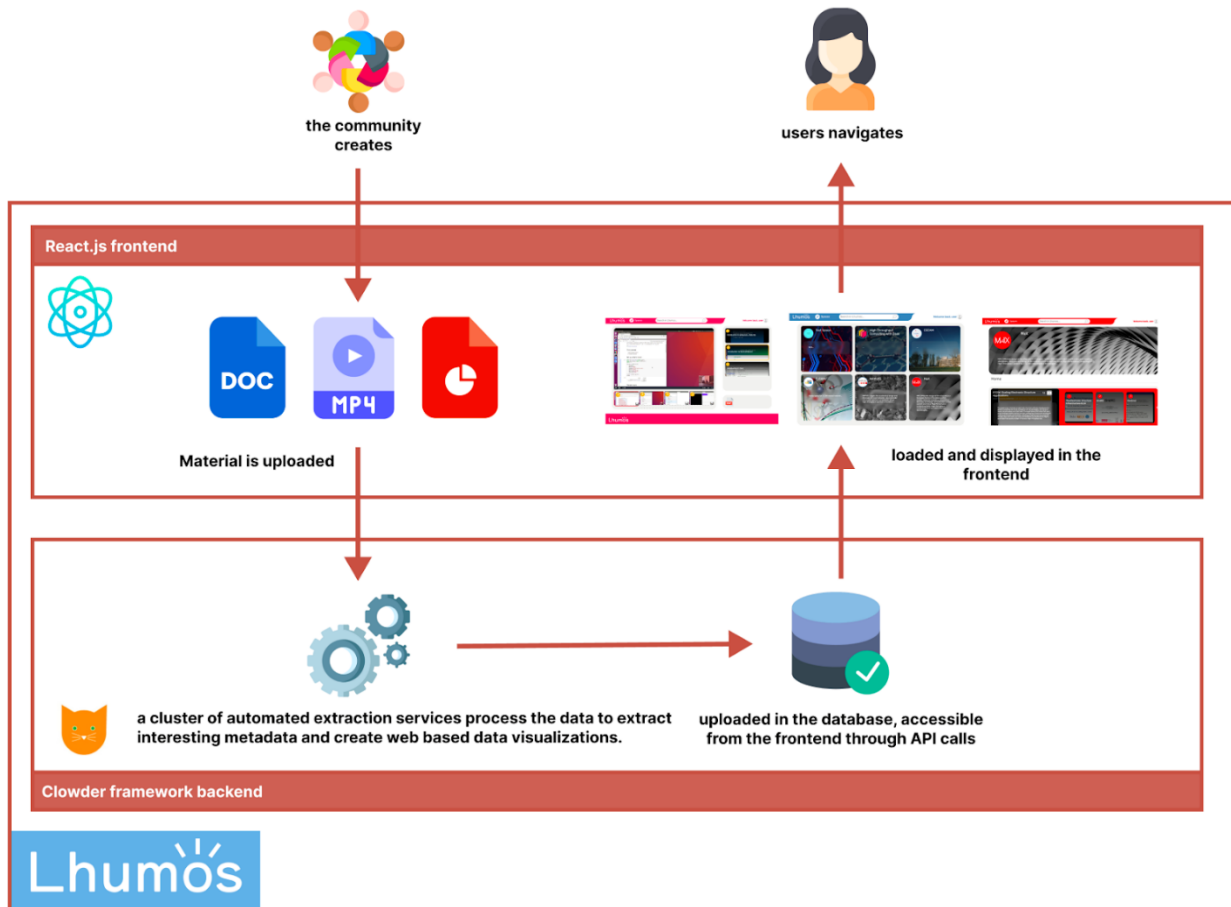
3. Clowder back-end

Figure 3: Lhumos frontend – backend interaction

The Lhumos platform is built on top of Clowder, an open-source data management framework. Clowder provides a flexible backend for storing, organizing, and processing diverse datasets. Key features of the Clowder backend utilized by Lhumos include:

- Customizable metadata schemas
- User authentication and access control
- RESTful API for programmatic data access
- Extractor framework for automated metadata generation
- Scalable storage of large files and datasets

5.1 Automatic Metadata Extraction

Lhumos leverages Clowder's extractor framework to automatically generate rich metadata from uploaded content. For example, when a video lecture is uploaded:

- Slide content is extracted from video frames
- Timestamps are generated for slide transitions
- Keywords are extracted from transcripts and slides

This automated metadata enrichment enhances searchability and allows for advanced content navigation.

5.2 Frontend-Backend Communication

The Lhumos frontend is a modern web application built with React. It communicates with the Clowder backend via RESTful API calls. Key interactions include:

- User authentication and session management
- Fetching course and content metadata
- Streaming video and file content
- Searching across content and metadata

The frontend implements caching and lazy loading to optimise performance when browsing large content libraries.
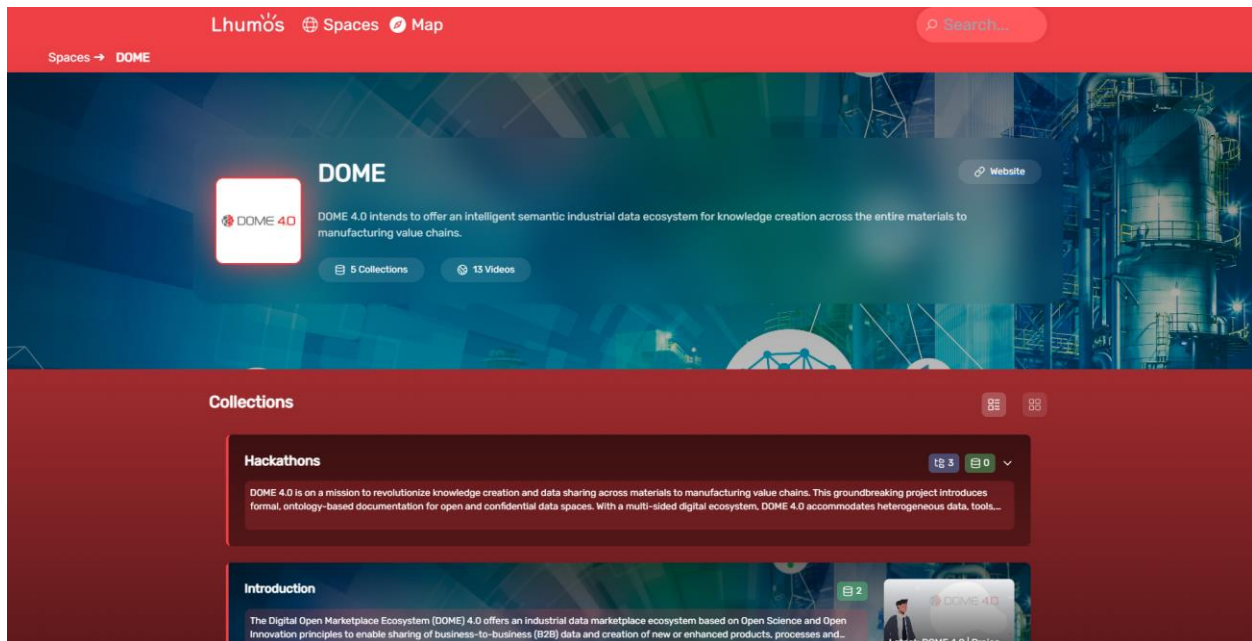
4. Dissemination & Sustainability

Figure 4: DOME space inside Lhumos

The Lhumos platform, as a key component of the DOME 4.0 education and training strategy, was actively disseminated to the scientific community through various channels to foster awareness, encourage adoption, and promote the sharing of knowledge and best practices in materials science and high-performance computing, some examples are:

- Embed links on partner websites
- Official Lhumos launch webinar to introduce platform to material science community
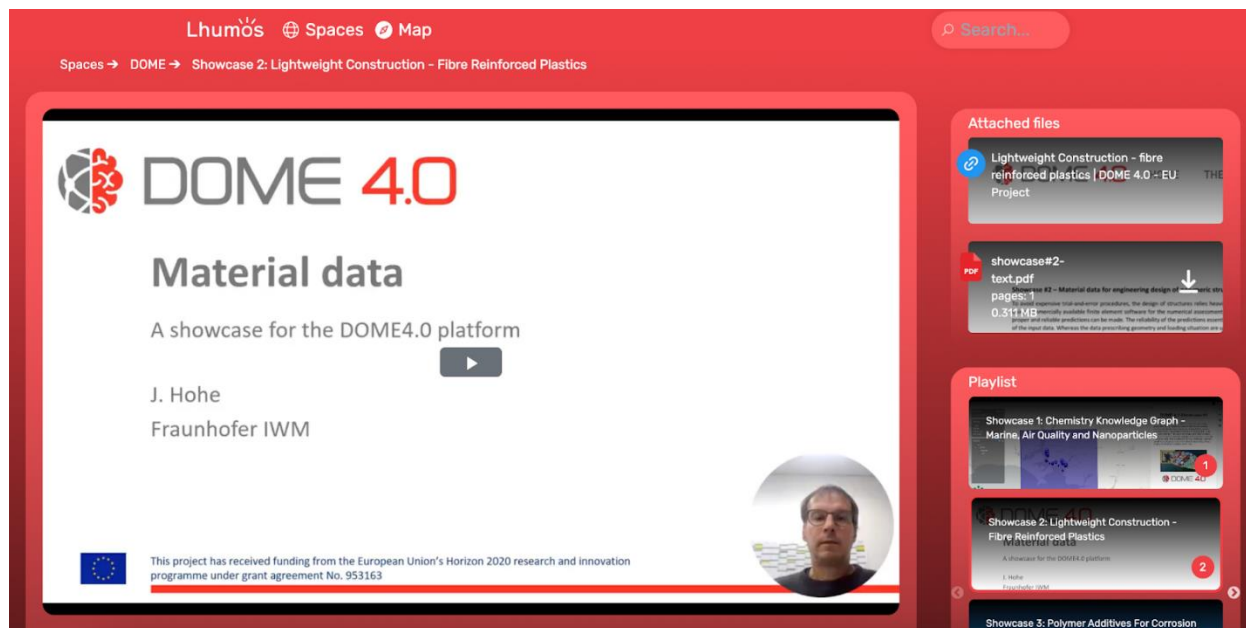- Poster session of Lhumos in various relevant scientific events

Figure 5: Video playback demo with attachments

By integrating with DOME 4.0, Lhumos can reach a broader audience and maximise the value of its educational content for the material sciences community. The low overhead required to sustain the platform ensures that this value will continue beyond the lifetime of the DOME 4.0 project itself.

5. User metrics

We use Plausible Analytics, a privacy-focused solution, to track engagement on the Lhumos   platform as it transitions out of its alpha phase.

Key statistics for Lhumos during this early stage:

- Total visitors: 1,324
- Peak daily visitors: 32 (June 26, 2024)
- Average daily visitors: 5.4
- Days with 10+ visitors: 37

These figures are promising for a newly launched platform, which was released in Q1 2024. Visitor numbers fluctuate daily, with notable peaks of interest likely corresponding to specific events or content releases. The 37 days with 10+ visitors, achieved within just a few months of launch, demonstrate growing interest in the platform.

6. Deviations from Annex 1

There are no deviations from Annex 1

7. Conclusions

The DOME 4.0 education and training model, exemplified by the materials created for the Lhumos platform, enabled effective dissemination of project results and empowered new users to extract value from the industrial data ecosystem. Interactive, multimedia content allowed engaging a broad audience.

Continued availability via the Lhumos platform will facilitate further adoption and impact beyond the project lifetime.

8. Lessons learnt

The development and deployment of the Lhumos platform as part of DOME 4.0's education and training strategy provided several valuable insights. First, automatic metadata extraction proved essential for making content discoverable and reusable, though careful curation was still needed to ensure quality. The development of a mediator API system greatly improved interoperability between different data sources and services, while implementing a robust caching strategy significantly reduced bandwidth usage and enhanced maintainability of the platform

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Project partners:

#	Type	Partner	Partner full name
1	SME	CMCL	Computational Modelling Cambridge Limited
2	Research	FHG	Fraunhofer Gesellschaft zur Förderung der Angewandten Forschung E.V.
3	Research	INTRA	Intrasoft International SA
4	University	UNIBO	Alma Mater Studiorum – Universita di Bologna
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6	Research	UKRI	United Kingdom Research and Innovation
7	Large Industry	SISW	Siemens Industry Software NV
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