

Whitepaper

EDGE-Skills

Creating the future of
data spaces in Europe



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1. Introduction

1.1 Data ecosystems – decentralized and sovereign data sharing

In today's digital age, data has become a valuable asset, driving innovation and economic growth. It is a cornerstone in the modern digital economy, providing insights, improving services, driving efficiency and contributing to an individual and economic development. However, the traditional models of data collection and usage often overlook the rights and interests of organisations and individuals, leading to privacy concerns and a lack of trust. The European Commission published in 2020 their data strategy indicating that "citizens will trust and embrace data-driven innovations only if they are confident that any personal data sharing in the EU will be subject to full compliance with the EU's strict data protection rules. At the same time, the increasing volume of non-personal industrial data and public data in Europe, combined with technological change in how the data is stored and processed, will constitute a potential source of growth and innovation that should be tapped."¹

A data ecosystem aims to address these issues by placing individuals and organisations at the center of data management, ensuring they have control over their information.² It is a framework that encompasses the collection, storage, management, and utilization of data. It involves various stakeholders, technologies, and processes working together to ensure that data is used effectively and ethically. It is therefore built on principles of transparency, consent and user empowerment, aiming to create a more equitable relationship between data providers and data consumers.³

Personal and non-personal data sharing in a data ecosystem provides several benefits for individuals and organizations at the same time:

- **Enhanced privacy and security:** By granting individuals control over their data, data ecosystems minimize the risk of unauthorized access and misuse. Decentralized storage and encryption further strengthen security, protecting personal data from breaches and cyberattacks.
- **Increased trust:** Clear rules and governance frameworks within data spaces build trust among participants, ensuring data is used ethically and responsibly. When individuals have control over their data and understand how it is being used, they are more likely to trust digital services (particularly important in sectors such as finance and healthcare, where sensitive personal data is involved). This trust is crucial for the adoption of new technologies and services, fostering a more cooperative and engaged digital society.⁴

¹ European Commission February 2020; A European strategy for data, p.1

² MyData: An introduction to human-centric use of personal data, July 2020

³ Fraunhofer ISST: Data Ecosystems, October 2019

⁴ Mark Fenwick and Paulius Jurcys: Building a Green Data Future



- **Empowerment and autonomy:** Human-centric ecosystems empower individuals and organisations by giving them the ability to manage their data. This includes deciding who can access their data and for what purpose, as well as the ability to revoke access if necessary.⁵
- **Innovation and economic growth:** With more data available in a controlled and ethical manner, businesses and researchers can innovate more effectively. This can lead to advancements in various fields, such as healthcare, smart cities, and personalized services, driving economic growth and improving quality of life.
- **Ethical data usage & transparency:** Data ecosystems promote ethical data usage by ensuring that data is collected and used with the individual's consent. This aligns with global data protection regulations, such as the General Data Protection Regulation (GDPR), and promotes responsible data practices. Moreover it enhances transparency and ensures individuals are informed about how their data is being used and therefore can make informed decisions about sharing their data. This transparency builds trust between individuals and organizations, encouraging more people to participate in data sharing initiatives.⁷

1.2 Challenges of implementing data ecosystems

Implementing data ecosystems comes with several challenges, despite their numerous benefits.

Firstly, there is the technical complexity involved. Ensuring data can be seamlessly shared across different systems requires standardized formats and protocols. Robust security measures, such as encryption and decentralized storage, are essential but technically challenging and resource-intensive. Additionally, systems must be scalable to handle large volumes of data while maintaining performance and security.

Regulatory compliance is another major challenge. Organizations must adhere to various data protection laws, such as the GDPR in Europe, which necessitates careful planning and ongoing monitoring. Navigating the complexities of cross-border data transfers is also difficult due to differing regulations across jurisdictions.⁸ Data governance complements this challenge with each organisation setting their own data usage policies.

Building trust is fundamental. Convincing individuals and organisations to trust new systems with their personal and non-personal data requires transparency and consistent demonstration of security and ethical practices. Encouraging organizations to adopt human-centric data practices can be difficult, especially if they are accustomed to traditional data models. Organizations need to see clear benefits to change their existing practices.⁹

⁵ MyData: An introduction to human-centric use of personal data, July 2020

⁶ Mark Fenwick and Paulius Jurcys: Building a Green Data Future

⁷ Enterprise Big Data Framework: Why Data Ethics Matters: Establishing a Framework for Responsible Data Practices

⁸ World Economic Forum: 12 ways a human-centric approach to data can improve the world, August 2021

⁹ Mark Fenwick and Paulius Jurcys: Building a Green Data Future



Economic and business models present another set of challenges. Developing models that provide sufficient incentives for both individuals and organizations to participate in a data ecosystem is complex. Implementing and maintaining these systems can be costly, and organizations need to see a clear return on investment.¹⁰

Ethical considerations are paramount. Balancing the interests of individuals, organizations, and society can be complex, especially when there are conflicting priorities. Establishing and enforcing ethical guidelines for data usage is essential to prevent misuse and ensure practices align with societal values.¹¹

Finally, infrastructure and resources are critical. Building the necessary infrastructure to support decentralized and secure data storage and sharing requires significant investment. Allocating sufficient resources, including financial and human capital, is crucial for the development and maintenance of these ecosystems.¹²

Addressing these challenges requires a concerted effort from all stakeholders, including technical experts, regulatory bodies, organizations, and users.

2. EDGE-Skills - a Prometheus-X project

The omnipresent influence of digital transformation raises a question: how can societies harness the transformative power of data while safeguarding individual autonomy and dignity? At the crossroads of technological advancement and human rights lies a challenge - and a profound opportunity - to create systems that balance these priorities.

Prometheus-X, a non-profit organisation, founded in October 2021 and uniting several public and private members, with the mission to fund, govern and develop open source building blocks for data spaces, seeks to empower individuals and organisations with control over their data while cultivating an ecosystem of trust and interoperability, enabling organisations to share and utilise data responsibly and effectively.

At its core, Prometheus-X aims to elevate the role of data in digital societies by creating an open and decentralised data ecosystem designed to serve humanity. This vision is deeply rooted in the principles of digital human rights and stringent data protection standards, fostering trust while simultaneously unlocking significant opportunities for innovation and economic growth.

The **EDGE-Skills project** (European Dataspace for Growth and Education-Skills), which is led by Prometheus-X, aims to provide a human-centric, distributed and sovereign data space

¹⁰ World Economic Forum: On the Importance of Human-Centricity and Data, January 2021

¹¹ Mark Fenwick and Paulius Jurcys: Building a Green Data Future

¹² Fraunhofer ISST: Data Ecosystems, October 2019



infrastructure that is deployed and ready to use as plug and play through a set of innovative cloud services with first use cases in the education and tourism domains.

EDGE-Skills unites 36 organisations from eight European Union (EU) countries to address pressing challenges in education and workforce competitiveness. By federating initiatives across Europe, it aims to impact over 5 million learners by the end of 2026 by pursuing the following three core objectives:

1. Developing and deploying high-value education and skills data ecosystems.
2. Innovating cloud-to-edge services for the education and skills data space.
3. Ensuring accessibility for all stakeholders.

Prometheus-X providing building blocks as digital commons is enabling an open and decentralised data sharing infrastructure thus delivering a practical framework for EDGE-Skills to share data and services for the education and skilling sector.

Prometheus-X's mission: to enhance the competitiveness of the EU economy by enabling seamless data sharing not only in the education and skills sectors but also tourism and others. This is achieved by aggregating insights into architecture, governance, business models, and stakeholder coordination.

The long-term vision involves:

- Building technical foundations: Reliable, interoperable building blocks.
- Driving practical use cases: Demonstrating value across sectors.
- Facilitating cross-sectoral data flow: Enabling innovation for individuals, researchers, and organisations.

3. Data spaces and their impact on education and skilling

Data spaces are collaborative, secure and interoperable environments where data from various sources can be shared and accessed while maintaining data sovereignty and privacy. They are designed to facilitate data exchange between different stakeholders, including individuals, businesses, educational institutions, and government bodies. By leveraging data spaces, stakeholders can collaborate more effectively, leading to improved decision-making and innovation.¹³ Particularly in the realms of education and skilling they can enhance educational outcomes and skill development and offer significant benefits for all stakeholders. Prometheus-X's data space infrastructure is largely used in the skills and education sector, other sectors are also using it to deploy data spaces (tourism, media, smart cities, legal).

¹³ MyData: An introduction to human-centric use of personal data, July 2020



4. Data spaces in practice

4.1 The central role of use cases

Data space use cases are central to demonstrate how a data space creates interoperability and facilitate data exchange for the development of innovative solutions. Data space use cases, for instance in the context of skills and education can be defined as a secured and specific environment in which two or more organisations of different natures (public, private, universities, schools, employment agency, Edtechs, HRtechs, HR services etc.) rely on a data space to generate business and / or societal value through mutualisation of data and use of this data to produce innovative services (personalised recommendations, analyses, dashboards, etc.). A detailed list of benefits for education and skills stakeholders can be found in the Annex II.

EDGE-Skills gathers more than 30 partners around 25 high value use cases, organised around 5 families, called usage scenarios, as described below:

Usage Scenario 1

Decentralised skill analytics and forecasting: Helping organisations introduce and maintain an Artificial Intelligence (AI)-based skills management, which allows analysis of existing skills of employees, benchmarking with their sector, identifying skill gaps and closing the skill gaps by offering personalised training opportunities to employees in support of strategic business directions and for students to support shaping their future. The EDGE-Skills use cases belonging to this scenario are:

- Organizational-level skill gap analysis (as-is-status vs target-status), by imc AG
- Up- and reskilling of employees within an organization, by imc AG
- Trusted ecosystem for skills foresight, by HeadAI
- Skill gaps analytics for students, by Schülerkarriere

Usage Scenario 2

Distributed learning analytics to personalise education: Personalised learning is considered to be the most efficient of all training and education approaches because it is tailored to the individual needs, interests and learning style of each student or learner. Recent advances in AI and automatic data collection techniques are paving the way for personalised learning at lower cost and thus large scale. For this to happen, it is critical to have a trusted data space of services to collect, store and process the learning records of learners. The use cases belonging to this scenario are:

- Job opening prediction, by the University of Koblenz
- Lifelong availability of learning data (DAPO-X), by Inokufu
- Learning traces of teachers and course designers (WikiLOM), by Inokufu
- Learning traces from websites and browsing activities (WALLY), by Inokufu
- Digital technologies for education, by Prof en poche
- Using game data & learning analytics to provide custom pedagogical feedback, by Games for Citizens / Ikigai
- Matching learning achievements with skills ontologies, by EDUNAO



Usage Scenario 3

Mutualise data to train AI: Bringing together data from various sources while ensuring privacy and security is essential for enhancing AI capabilities. By leveraging mutualized data, AI systems can be trained more effectively and widely spread in a trustworthy manner. In this usage scenario, Rejustify is looking to support use cases where data providers and AI providers are looking to benefit from a common approach of mutualising siloed data sets. Following use cases are part of this scenario:

- [Train STEAM with dynamic maths, by Cabrilog](#)
- [AI-based teacher assistant, by Ventr](#)
- [Recommender systems, by Maskott](#)

Usage Scenario 4

Personalised skills matching: Interconnecting powerful, resource-efficient and diverse AI services and data sources (skills ontologies, job boards, training catalogues, etc), that offer people skills assessments, career recommendations, skills gap analysis and job matching to help them design their lifelong learning and career journey. The EDGE-Skills use cases belonging to this scenario are:

- [Enhance GEN_SCAN and create a digital skills assessment tool to promote up-skilling and re-skilling of people, by la Grande Ecole du Numérique](#)
- [AI assisted learning object creation and skill mapping, by Edtake](#)
- [EU job matching for Koreans, by Visions](#)
- [Skills for world of work for students in LAB, by HeadAI](#)

Usage Scenario 5

Learning analytics for virtual reality (VR): Mutualising VR learning analytics to build new and better innovative training courses: providing synthetic dashboards for teachers and learners on distributed infrastructure, using AI services to provide automatic skills assessments using for instance data from VR training to technical gestures. Following use cases belong to the scenario:

- [VR data sharing for automatic customization of immersive learning experiences, by WiDiD](#)
- Video4XR, by le CNAM

Usage scenario 6

Delivering a seamless experience for travelers with reduced mobility (PRM) through MyTravelConnect, an identity management and consent tool that enables data sharing across digital travel services (trains, flights, urban mobility, hotels, leisure activities, etc.). The “Once Only” approach eliminates the need to repeatedly input personal data (e.g., accessibility requirements in the context of PRM) on every platform. In addition, by choosing which data to share across digital services, travelers can enjoy a highly personalized user experience on any channel, including AI Travel Assistants or Companions.



4.2 Use case example: Skill gaps analytics for students

Concrete examples of high business and societal value brought by data spaces in the context of skills and education can be found when looking closer to specific use cases inside the EDGE-Skills project. We can explore in particular the use case led by Schülerkarriere, which aims to effectively support students in finding a career fitting to their expectations and identify talents for relevant professions. By effectively analysing skills gaps, it aims to improve the matching between students' skills, the requirements of the labor market and companies.

Schülerkarriere is a network that offers a wide reach to students, thanks to its integration into relevant learning and placement portals and the digital school infrastructure. It enables pupils to search for suitable apprenticeships, internships, or study places as part of their career guidance lessons. By being integrated into the official school infrastructure, Schülerkarriere reaches pupils, teachers, and parents directly in the schools.

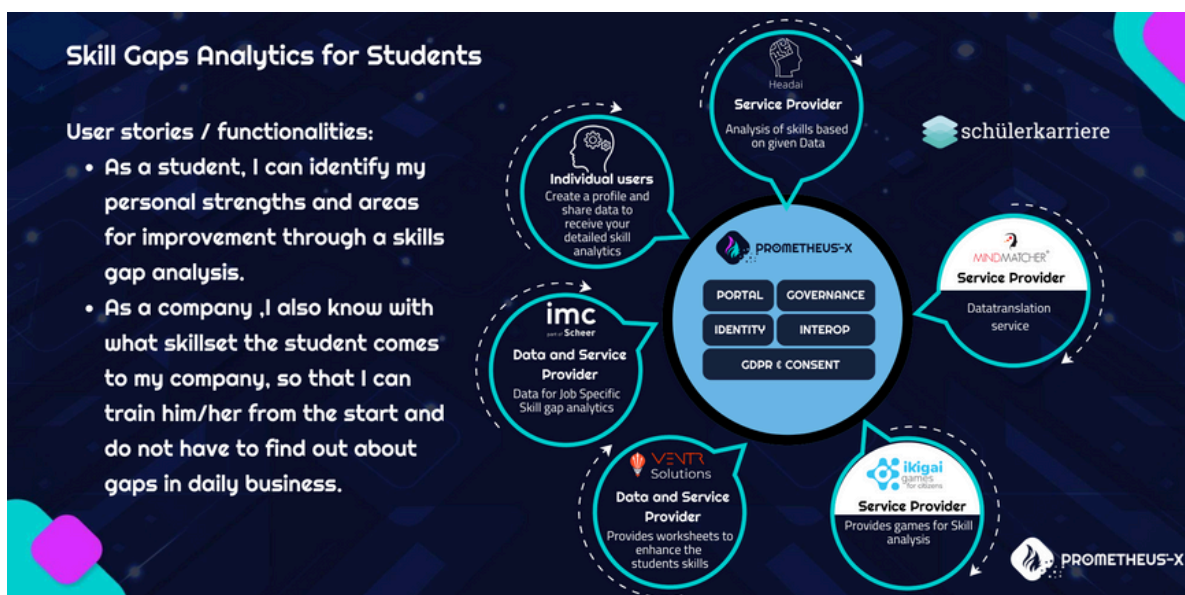


Figure 1 - Use Case: Skill gaps analytics for students - partner structure

For this specific use case, they collect information about students' interests, preferences, strengths, and professions to create a detailed profile. This data is then analysed and compared with their catalogue of job advertisements and occupations to find skills gaps between the student, their "dream job" and the "right job" based on the student's skills. In addition, the data can be used to figure out how to help the student acquire missing skills with pre-courses, or if the student is joining a new company, the company can specifically prepare the student to acquire the missing skills.

The added-value brought by this use case can be summarised below:

- Personalised career guidance for students: Utilising the student's data provides personalised career guidance to students by aligning their interests, preferences, and strengths with suitable apprenticeships, internships, or study places and show them where they would need to improve.



- Targeted skill development for companies and schools: After identifying the skill gaps, provide support in acquiring those missing skills and or create awareness in companies and schools. That makes the learning process more efficient by focusing on areas where development is needed.
- Company HR benefits: Companies hiring students with known skill gaps are aware of their strengths and weaknesses and can actively work towards filling these skill gaps. This allows companies to tailor their training programs to further enhance these skills.

4.3 Use case example: MyTravelConnect

MyTravelConnect was developed as part of the EONA-X data space for tourism and mobility, which uses the Prometheus-X stack and the VisionTrust tool. Its main purpose is to give travelers control over their personal data, by allowing them to reconcile multiple digital travel service accounts before deciding what information to share. The solution, which was initially designed to support travelers with reduced mobility (PRM), will ultimately benefit all travelers in multimodal value chains. Shared data can include identity and payment data, accessibility requirements, transaction records, itineraries, and much more.

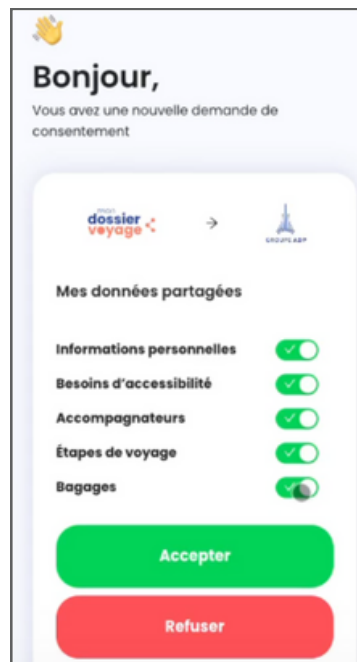


Figure 2 - Data sharing consent management

By co-designing personal data sharing scenarios with travel providers, MyTravelConnect streamlines the travel experience across its partner network. The central feature is the “Magic Button,” which can be integrated into existing travel services to facilitate seamless account reconciliation, data exchange, and consent management - all without disrupting the user’s journey.

Although MyTravelConnect relies on peer-to-peer data exchange between travel operators, it also offers a digital wallet service that stores essential information - like identity and accessibility needs - that can be used on any participating digital service.



Figure 3 - My Travel Wallet (traveller file area)

A pilot launched in 2024, and four use cases are planned for implementation in 2025 under the EDGE-Skills initiative.

- **Reuse of accessibility needs data for a luggage service:** Alltheway is a digital service that assists travelers with their luggage - such as transporting bags between airports and hotels. Its primary clientele includes business travelers and people with reduced mobility (PRM). By integrating the MyTravelConnect Magic Button, Alltheway allows users to quickly and seamlessly share information to determine if they qualify for its luggage service - recognizing that certain areas, transportation modes, or accessibility needs may not be covered - and to streamline and speed up the onboarding process.

Figure 4 - MyTravelConnect (importing travel file data into the alltheway service)



- **Once Only principle for PRM assistance services:** Many travel providers (train stations, airports, etc.) offer assistance services - such as escorting PRM travelers from a train to a taxi. MyTravelConnect enables these services to apply the “Once Only” principle by standardizing and simplifying the onboarding process, so PRM travelers no longer have to re-enter their personal and accessibility information each time.
- **MonDossierVoyage for travelers with reduced mobility:** In 2024, the MonDossierVoyage service was developed to offer itinerary recommendations tailored for travelers with reduced mobility. By integrating MyTravelConnect at its core, MonDossierVoyage presents mobility, hospitality, and tourism activity options that precisely match each user’s accessibility needs.

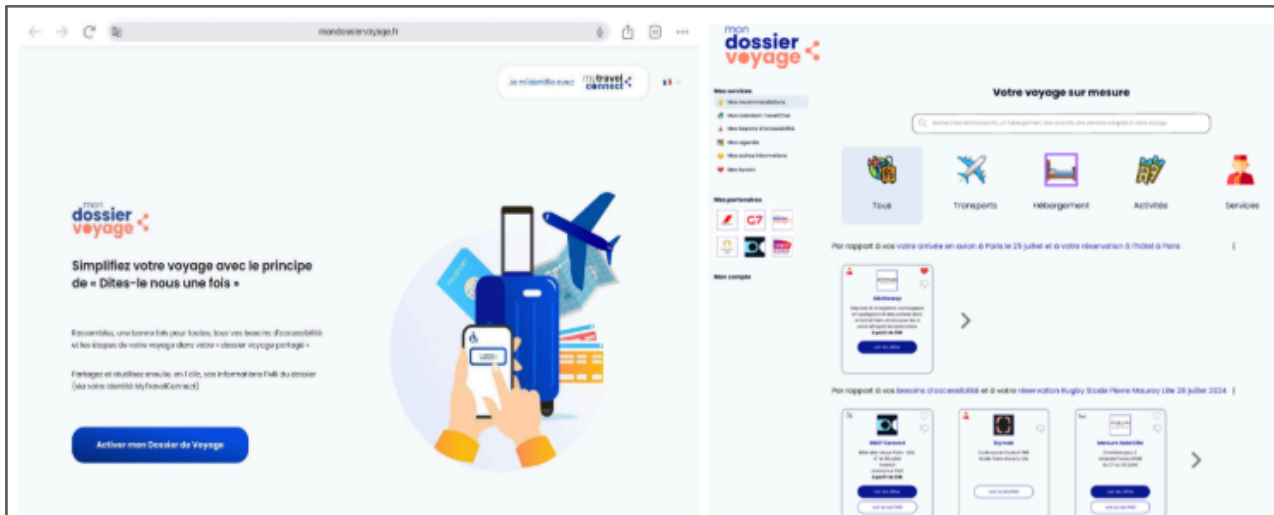


Figure 5 - Search engine for personal recommendations tailored to your PRM needs

- **Gen4Travel AI Travel Assistants/Companions:** Gen4Travel is an agent-based AI middleware that provides travel providers with a toolbox for building AI companions based on the shared data in the EONA-X Data Space. By integrating MyTravelConnect, Gen4Travel Companions enable users to seamlessly share their personal data between these AI companions and their various digital travel services.



Figure 6 - Gen4Travel demo (screenshots)



5. Data space infrastructure - Building Blocks

The project is structured around various building blocks, which are open-source digital commons designed to provide well-defined services that facilitate trustworthy data sharing in multiple aspects.

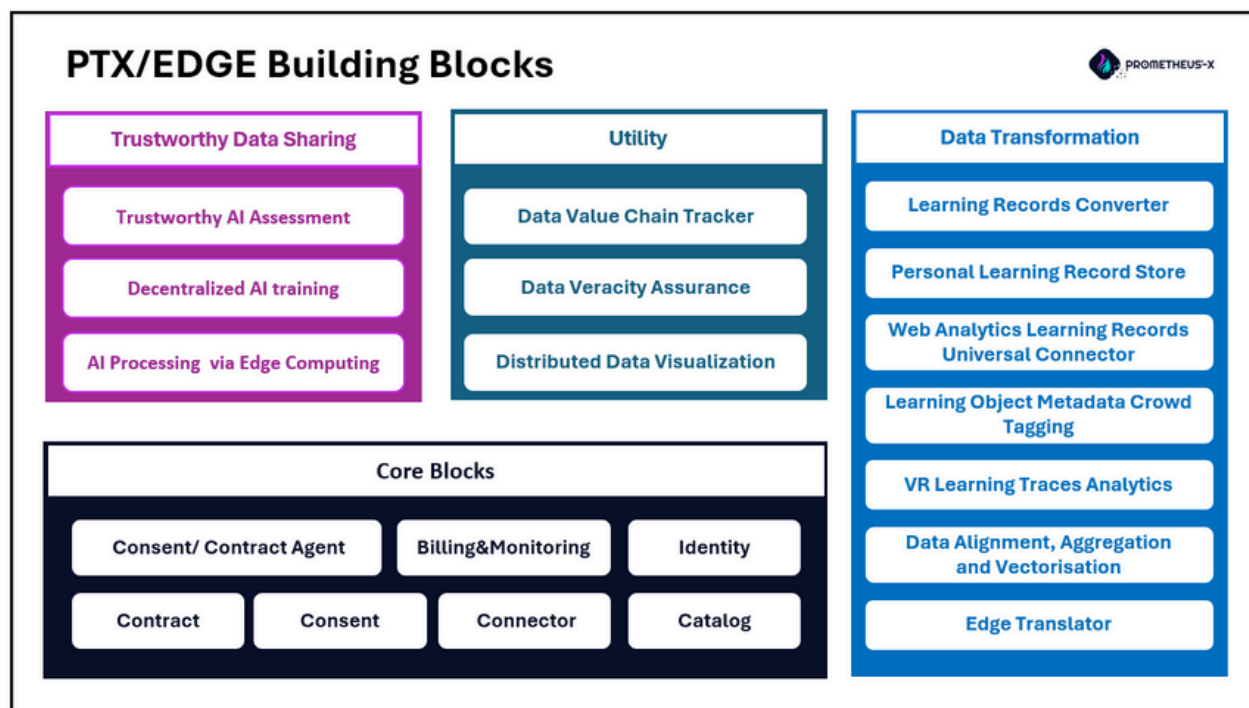


Figure 7 - The four categories of Prometheus-X building blocks

The **Core Components Catalog** registers all services, including those of data or AI providers, and infrastructure services which can be combined to build so-called service chains. Such chains, allow to sequence the data and service exchange between different providers to offer complex functionalities, like anonymizing and transforming the data from different representation formats to the input of an analytics service.

The **Contract** and **Consent** service describe the agreements of businesses and individuals participating in data sharing scenarios while identity offers a decentralized mechanism to identify participants. They allow to implement the access control to data and services, based on agreements and GDPR compliant consents.

The project has an **Identity** component responsible for identity management while actual data transfers and system status at the level of business services and applications is logged and handled by the Billing/Monitoring component.

Prometheus-X also offers **Utility** components to facilitate data-driven business models. Such components, like Data Value Chain Tracker and Data Veracity Assurance, which trace the data being shared across participants and evaluate whether the characteristics and quality of the data



meets the predefined conditions which also determine how different participants are incentivized for sharing and processing data.

A clear added value of the ecosystem is the support for **trustworthy data sharing**. Trustworthiness in this case refers to the dependability, scalability and robustness of the data processing and AI training algorithms, with guarantees for privacy preserving.

This is supported by Edge Computing, a block to manage function-as-a-service computations with privacy and performance requirements, Decentralized AI training to support federated learning algorithms and Trustworthy AI assessment which offers services to cover the entire lifecycle of AI model management and evaluate and ensure requirements of AI Act.

Data transformation blocks offer generalized services adapted mostly but not exclusively to the needs of skills and education data space. These offer services to convert and store data, including the support for life-long learning by offering personal learning record store and facilitating crowd-tagging and privacy-preserving web analytics of learning activities. VR traces analytics concentrated on activities performed on digital twins of physical objects (such as a car or a welding machine) in virtual classrooms. The Edge Translator targets the processing, matching and mapping of skills data, covering both skills of an individual, skills taught by a set of courses or activities and skills required for a given position or qualification.

These components help data and AI provider concentrate on their added value services, relying on well tested and flexible data transformation and processing functionalities.

Such blocks provide infrastructure services to support the connection across different data providers and data consumers (e.g., AI services). To connect to the data space, organizations need to have an instance of Prometheus-X Dataspace Connector (PDC). Organizations connect to each other and the Data Intermediary via Prometheus Dataspace Connectors (PDC), that conform to both Gaia-X and IDSA (International Data Space Association) connector specification.

The following figure (Figure 8) shows how these blocks are used within a concrete data sharing context.



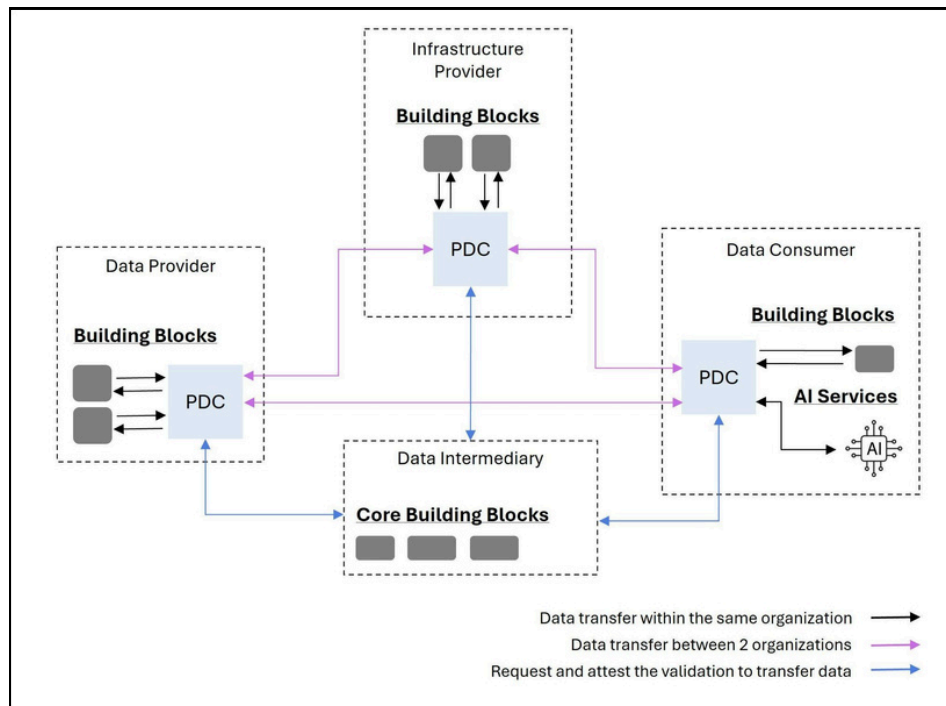


Figure 8 - Example of data space structure

The data intermediary hosts core components which are responsible for the management and governance of the data space. Both data provider and data consumer may host additional building blocks but they can also rely on those partners who offer these blocks as infrastructure services. Service chain calls are orchestrated by the PDCs of the organizations involved, which are also responsible to check and ensure that all calls are according to the pre-defined contracts across participants.

6. Interoperability and interconnectivity

6.1 Standards

During the design and implementation of Prometheus-X services, we follow the relevant standards and industrial best practices:

Data consumed/produced by services is captured in JSON-LD. The project uses xAPI (Experience API) to describe learning records while components responsible for processing skills information are able to handle categories of ESCO and Rome ontologies, although the services can be more flexible than the categories defined by these.

OpenAPI was used to describe the services which are available via REST endpoints. Components are packaged and deployed in Docker containers to make the overall ecosystem scalable and manageable.



To describe rules and policies to be applied in a business collaboration, the contract component is able to handle Open Digital Rights Language (ODRL) expressions. The project will follow the ISO/IEC TS 27560:2023 standard for consent description.

For the testing of individual services and combined service chains, we use portable, technology-independent behavioral tests. Project components are checked to find security vulnerabilities described as CVE (Common Vulnerabilities and Exposures) entries.

Standards followed by the BBs include the protocols, guidelines, and formats they use:

- Data format: [IEEE/xAPI](#)
- [JSON-LD](#) for schema definitions
- [ISO 3166-1 alpha-2](#) for location country codes
- [ISO 8601](#) for Date and time format
- [ODRL](#) for contract policies
- [JSON](#)
- [RDF](#) (to describe data)
- [RDFS](#) (for defining ontologies)
- HTML (for reports)
- XML (for reports)
- JavaScript
- Well known ontologies (like [skos](#), [schema.org](#), ESCO,...)
- [YAML](#)
- [TOML](#) for configuration
- [ISO 8000-61:2016](#) – Data Quality – Part 61: Data quality management: Process reference model
- [ISO 8000-117](#) for data quality and data immutability
- [ISO/IEC 25000:2014](#) – Systems and software engineering – Systems and software Quality Requirements and Evaluation (SQuaRE)
- [NextFlow](#) for scenario format
- Data transfer: sFTP protocol
- Data Cards: ALT-AI adheres to practices for providing metadata about datasets, enhancing transparency
- Model Cards: ALT-AI supports the documentation of machine learning models, outlining their intended use and performance
- [ERC-20](#) for token standards on the Ethereum blockchain
- Universal Unique identified (UUID) based on MD5 hash 128-bit or, in the case of decentralized services, [Decentralized identifiers \(DIDs\)](#) to allow verifiable identity.
- Pickle and Joblib for AI model
- D3.js and Chartist.js



6.2 Framework

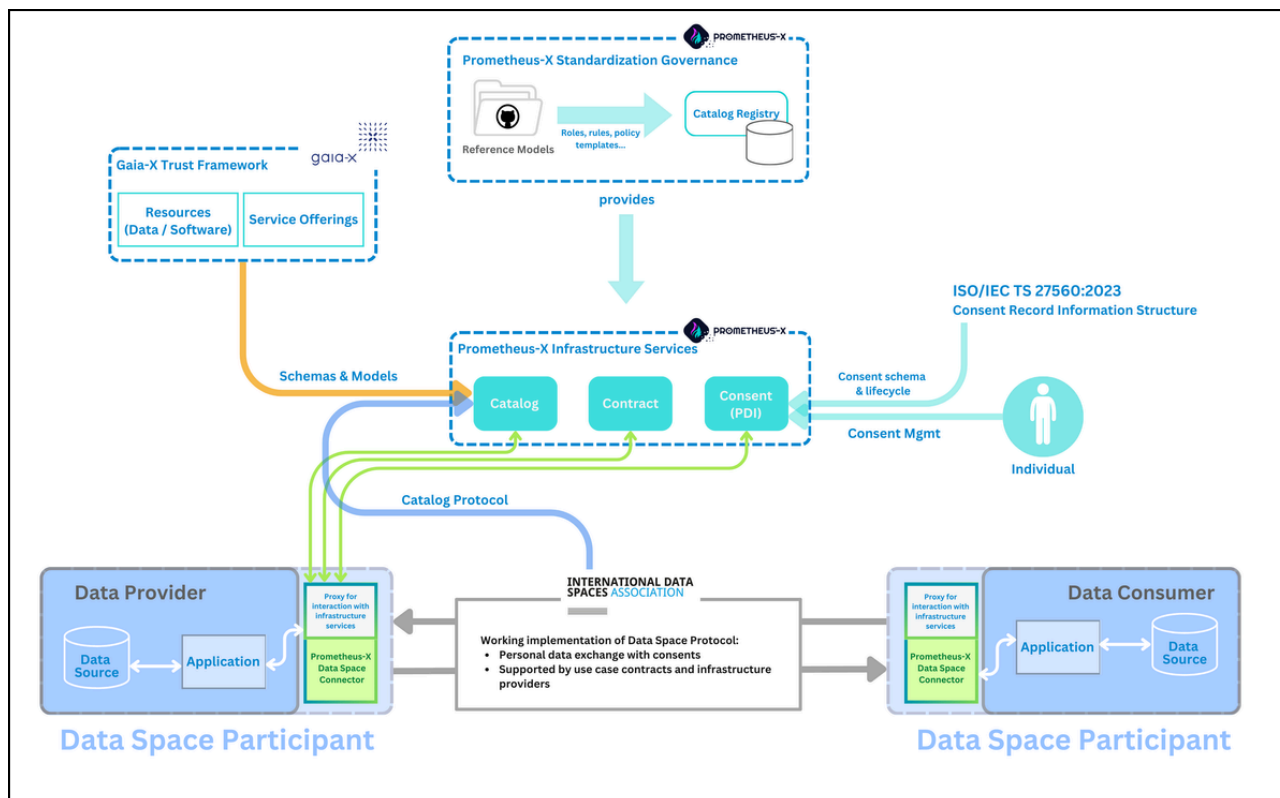


Figure 9 - Prometheus-X data space ecosystem

As Figure 9 shows, Prometheus-X was designed to be compatible with the major related frameworks. Prometheus-X catalog component takes Gaia-X-compliant resource and service descriptions, while the catalog registry roles, policies and templates are compliant with that of the available reference models.

The way a Prometheus-X Dataspace Connector (PDC) communicates with other PDC instances, run at different participants of the data space, conforms with the Reference Architecture Model (RAM) of IDSA.

6.3 Adaptation on other sectors

Prometheus-X building blocks are designed to align with the general guidelines and frameworks established by prominent organizations such as IDSA, Gaia-X, and the Data Space Support Centre (DSSC). Prometheus-X strives for interoperability with key standards like the IDS Dataspace Protocol and the IDS Catalog Protocol, which leverages DCAT to define catalog metadata. Similarly, Prometheus-X supports the use of ODRL to specify access control policies for data exchange contracts, ensuring compliance with widely accepted approaches for secure and trustworthy data sharing.



This robust standards-oriented foundation makes Prometheus-X highly versatile, enabling its components to operate seamlessly across diverse domains beyond the realm of skills data. The core services within Prometheus-X are intentionally sector-agnostic, allowing for straightforward adaptation and integration into various industries and sectors.

Several data spaces have deployed or are deploying Prometheus-X components, such as: tourism data space (EONA-X), media data space (TEMS), smart cities data space (DS4SSCC), legal data space (Legal-X).

7. Summary

In order to improve the competitiveness of the EU workforce, the data strategy of the European Commission identifies a need for high-quality data for qualifications, learning opportunities, jobs and the skill sets of people. People, businesses and organisations should be empowered to make better decisions based on insights from skills data, which should be widely available.¹⁴ EDGE-Skills, led by Prometheus-X, supports this by building the infrastructure and business models to ensure high-quality skills data and high adoption of this infrastructure by all relevant stakeholders and across the EU.

It directly contributes to the success of the Digital Europe Programme by developing innovative building blocks for data spaces, deploying them on a multi-cloud sovereign infrastructure and ensuring their wide adoption through a set of high value use cases demonstrating their value for stakeholders across the continent, while aligning to established standards and frameworks of organisations like Gaia-X and IDSA.

In conclusion, EDGE-Skills and Prometheus-X represent a significant step forward in the development of a human-centric, data-driven education and skills ecosystem. By leveraging advanced technologies and promoting ethical data practices, these initiatives aim to create a secure, interoperable, and accessible platform that enhances the way education and skills are managed and utilized across Europe. Through their efforts, EDGE-Skills and Prometheus-X are empowering individuals, fostering innovation, and contributing to the overall growth and competitiveness of the European workforce.

¹⁴ European Commission 2020: A European strategy for data



Annex I: Benefits of Data spaces for education & skills

3.1 Benefits for individuals

Data spaces can significantly serve individuals and provide advantages in their education and career development.¹⁵

- **Personalized learning experiences:** Data spaces enable the aggregation of diverse educational data, allowing the creation of personalized learning pathways. By analyzing data on individual learning styles, preferences and progress, educational institutions can tailor their teaching methods to better meet the needs of each student.
- **Enhanced career planning:** With access to comprehensive skills data, individuals can make more informed decisions about their career paths. Data spaces can provide insights into the skills in demand, emerging job trends, and the educational requirements for various professions. This information helps individuals plan their education and training more effectively.
- **Lifelong learning opportunities:** Data spaces support the concept of lifelong learning. They help identify, recognize and develop people's capabilities through their lives, from education to employment by providing continuous access to educational resources and skill development opportunities. Individuals can easily update their skills and knowledge to stay relevant in a rapidly changing job market.
- **Improved credential verification:** Data spaces can streamline the process of verifying educational credentials and certifications. By storing and sharing verified data, individuals can easily prove their qualifications to potential employers, reducing the time and effort required for background checks.

3.2 Benefits for companies

Companies can greatly gain from data spaces in the field of education and skilling for several reasons:

- **Identification of future skills:** As the job markets are rapidly changing, companies struggle to forecast and identify future skills needs. By analyzing industry reports, job market trends, and feedback from their current workforce, companies can forecast new evolving technological skills which will be crucial in the next five years. This foresight allows them to invest in training programs and hire talent with these skills, ensuring they remain at the forefront of technological advancements.
- **Talent acquisition and management:** Companies can leverage data spaces to identify and recruit individuals with the right skills and qualifications. By accessing a broader pool of verified skills data, companies can make more informed hiring decisions and ensure that the new hires are well-suited to the specific needs of the organization. As a result, the company

¹⁵ <https://prometheus-x.org/use-cases/>



reduces the risk of hiring mismatches and improves overall team performance.

- **Employee development:** Data spaces enable companies to design targeted training programs based on the specific needs of their workforce. By analyzing skills data, companies can identify gaps and provide relevant training to enhance employee performance and productivity.
- **Skills data quality:** When individuals have control over their data, they are more likely to ensure that it is accurate and up-to-date. This accuracy is essential for organizations that rely on data for decision-making and strategic planning.
- **Innovation and competitiveness:** Access to diverse data sources through data spaces can drive innovation by providing businesses with new insights and perspectives. This can lead to the development of new products, services, and business models, enhancing competitiveness in the market.
- **Compliance and reporting:** Data spaces can help businesses comply with regulatory requirements by providing a secure and transparent way to manage and report data. This is particularly important in industries with stringent data protection and privacy regulations.

3.3 Benefits for educational institutions

Data spaces as well enhance the efficiency, effectiveness, and adaptability of educational institutions, ultimately leading to better educational experiences and outcomes for all. The key benefits for educational institutions are:¹⁶

- **Data-driven education:** Data spaces facilitate data-driven decision-making in educational institutions. By analyzing data on student performance, attendance, and engagement, educators can identify areas for improvement and implement strategies, tailoring their education programs to better match the skills and interests of students, leading to improved educational outcomes.
- **Collaborative learning environments:** Data spaces promote collaboration between educational institutions, companies, and other stakeholders. This collaboration can lead to the development of innovative educational programs and resources that better align with industry needs as well as simplify the recognition of certifications internationally.
- **Reskilling and upskilling:** In a rapidly evolving job market, reskilling and upskilling are essential. Data spaces provide a platform for continuous learning and skill development, enabling individuals to acquire new competencies and stay competitive.
- **Equitable access to education:** Data spaces can help bridge the gap between different socio-economic groups by providing equitable access to educational resources. This ensures that all individuals, regardless of their background, have the opportunity to develop their skills and knowledge.

¹⁶ <https://prometheus-x.org/use-cases/>



3.4 Benefits for labor market and society

In the labor market and society as well, data spaces offer significant benefits by enhancing the efficiency and effectiveness of various processes and aspects of daily life and economic activities:¹⁷

- **Enhanced job matching:** Data spaces can improve the efficiency of job matching by providing detailed information about job seekers' skills and employers' requirements. This leads to better alignment between job openings and candidates, reducing unemployment and underemployment.
- **Support for remote work:** Data spaces facilitate the sharing of data across geographical boundaries, supporting the growing trend of remote work. This allows businesses to tap into a global talent pool and provides workers with more flexible job opportunities.
- **Economic growth:** Data spaces can drive economic growth by fostering innovation and improving productivity. Access to diverse data sources enables businesses to develop new products and services, creating jobs and boosting economic activity.
- **Social inclusion:** Data spaces can promote social and digital inclusion by providing equitable access to educational and employment opportunities. This inclusivity is crucial in addressing the digital divide and ensuring that the benefits of digital transformation are shared equitably across society.
- **Public services improvement:** Governments can use data spaces to improve the delivery of public services. By analyzing data on citizen needs and service performance, they can make informed decisions to enhance the quality and efficiency of services.

Data spaces represent a transformative approach to managing and sharing data in the digital age and creating a common language that bridges the gap between education systems and the workforce. Within secure infrastructures they are ensuring ethical and sovereign data sharing between education institutions, companies and individuals. By leveraging the power of data spaces, we can create a more prosperous, inclusive, and sustainable future.

¹⁷ <https://www.skillsdataspace.eu/>



Annex II: EDGE-Skills Partners

PROMETHEUS-X

Prometheus-X is dedicated to developing a decentralised, open infrastructure for data sharing across multiple domains. The initiative seeks to establish a human-centric data ecosystem where individuals retain full control over their data and can share it securely and transparently.



VISIONS

The company collaborates with 25 EdTechs and serves 10,000 users, specialising in skills matching. Acting as a trusted data intermediary, it partners with numerous public and private organisations in the sector. Its services include consent and contract management for data spaces, with plans to develop B2C data ecosystem portals. To date, it has managed 20,000 consent data points.



UNIVERSITÄT KOBLENZ

The university contributes foundational scientific research to key initiatives such as International Data Spaces (IDSA), Gaia-X, BDVA, and FIWARE. Its expertise spans software engineering for decentralised data space systems, with a focus on security, privacy, data sovereignty, fairness and anti-discrimination, as well as legal and regulatory compliance. The university also manages data from 10,000 students, supporting its research and innovation efforts.



UNIVERSITÉ DE LORRAINE

With 60 research labs and 3,900 faculty members, Université de Lorraine drives innovation across diverse fields. Excelling in materials science, it focuses on sustainable resources, environmental stewardship, renewable energy, digital trust, and personalised healthcare for an aging society.



COZY CLOUD

Specialises in personal data stores and is widely trusted by public and private organisations for its distributed AI expertise and research. It develops Cozy, an open-source, versatile platform that allows users to import, store, and integrate various types of data from external providers via connectors. The platform currently serves over 80,000 users.



imc AG –

INFORMATION MULTIMEDIA COMMUNICATION AG

imc is an e-learning technologies leader with over 25 years of experience. As a full-service provider, the company offers learning platforms, learning content, and strategic expertise for global brands to achieve complex learning goals. Founded by IT visionary Professor August-Wilhelm Scheer out of a pioneering university initiative, imc has transformed learning for more than 10 million learners across over 1,300 organisations. Driven by bold innovation, imc goes beyond technology to deliver human-centered learning experiences.



HEADAI

The company partners with Technology Industry Finland and the City of Helsinki, collaborating with Tampere University to design and implement skills matching, analytics, and use cases. Its skills data interoperability service, trusted by public and private organisations, leverages cognitive AI to analyse context, word meanings, and relationships. Advanced analytics, available via API, enable skills demand forecasting and simulations across local, national, industry, and global levels, drawing insights from 25M job offers, 10M online sources, and 2M books.



MIND MATCHER

Advanced labor market analysis and skills identification from semi-structured data (e.g., CVs, regional skill needs). Personalized skill analysis and career matching by region, with insights on cross-functional skills. Built 4,076 semantic entities for ontology creation using public data (W3C, HROpen, AFNOR, etc.). Over 50,000 job and skills-related entities and 25,000 mappings in the Rome & ESCO Graph. Global, interoperable ontologies registry aligning ESCO (50,000 jobs/skills) and Rome standards (11,000 trades, 13,000 skills).



REJUSTIFY

Offers a comprehensive data interoperability service designed to seamlessly connect and exchange data across various platforms and systems. By enabling smooth integration between different data formats, sources, and technologies, the service ensures that organisations can efficiently access, share, and utilise data in real time.



ANTARES

The cloud service provider that will deploy the essential building blocks on its robust infrastructure and integrate them into its marketplace. This initiative will enable seamless access to a range of innovative solutions, offering customers enhanced flexibility and scalability. By leveraging its extensive infrastructure, Antares aims to deliver efficient, secure, and scalable services while promoting a dynamic ecosystem for businesses to access pioneering technologies and resources.



EDUNAO

The company operates hundreds of Moodle.org platforms for both K-12 and higher education, focusing on skills matching and learning analytics. As a global expert in Learning Record Store (LRS) deployment, the company manages hundreds of LRSs. Additionally, Edunao delivers fully managed Moodle environments to hundreds of organisations, ensuring seamless, customised learning experiences.



LA GRANDE ÉCOLE DU NUMÉRIQUE (GEN)

The national public body serves nearly all French citizens and digital skills training organisations in France. It focuses on skills matching and analytics use cases, with 15,000 training offer descriptions across 103 family/job descriptions in the digital domain. The organisation conducts skills analytics on job demand in the digital sector, analysing data from 15 to 20 million job offers.



PALM.AI

The company specialises in skills gap prediction, career trajectory estimations, and matching employees with available positions within the organisation. It offers a comprehensive framework of 30,000 skills concepts, structured into three levels, and available in six languages. This framework highlights the relationships between skills, enabling more accurate and effective talent management.



SCHÜLERKARRIERE

Serves 4.5 million German pupils and maintains a broad network of teachers and schools. It focuses on skills matching and skills analytics, leveraging its extensive network to provide tailored solutions that align students' abilities with career opportunities. By analysing skills development across a wide range of educational settings, the company aims to enhance learning outcomes and better prepare students for the workforce.



INOKUFU

The EdTech company offers personalised learning object recommendations to training organisations, focusing on skills matching and learning analytics. Additionally, it provides a dataset of learning traces (xAPI) for 2,000 users transitioning to high-demand jobs, supporting their development with tailored insights and data-driven recommendations.



VMPS CORPORATION – Prof en Poche

Prof en Poche provides learning apps to over 200,000 K-12 students, focusing on skills matching and learning analytics. It specialises in speech recognition for children in the classroom, handwritten digit recognition, and object detection and segmentation. With strong expertise in AI and data processing, the company also offers a dataset of learning traces (xAPI) for K-12 students, using data-driven insights to improve educational outcomes.



BUDAPESTI MUSZAKI ES GAZDASAGTUDOMANYI EGYETEM – BME

BME is the largest technical university in Hungary, with over 20,000 students and 2,000 researchers. The research groups involved have experience in more than 30 EU-funded projects. The main competencies of the researchers include critical system design, blockchain-based resilient applications, and cloud and edge computing. The team also possesses expertise in learning analytics and data-driven services.



NOMAD LABS AS

Nomad Labs is an innovative Web-as-a-Service (WaaS) studio based in Asia, focused on advancing the digital landscape. The company aims to drive commercialisation within the space while delivering valuable utility under the Nomad brand. The company provides a decentralised data governance protocol built on blockchain technology, designed to support the Web3 workforce—including founders, developers, collaboration managers, and artists. This solution offers essential tools and services that enhance functionality and security in the digital ecosystem.



DATA INTELLIGENCE INITIATIVE – DIO

The association serves as a collaborative platform for European stakeholders, driving the growth of the data economy. Acting as a "Use Case Factory," it connects theory with practice, promoting sustainable solutions in sectors like energy, mobility, circular economy, and digital twin technologies. The community, composed of data enthusiasts and enablers, believes that a transparent, open, interoperable, and sovereign data economy is crucial for creating a more efficient and sustainable future.



GAMES FOR CITIZENS

An association of 30 leading universities focused on advancing skills matching, skills analytics, and learning analytics. By leveraging advanced technologies and research, the group promotes data-driven approaches to identifying skill gaps, optimising learning pathways, and aligning education with industry needs. These efforts empower universities to provide personalised, effective education.



EDTAKE

Provides a comprehensive dataset of learning traces, capturing detailed interactions from teachers and course designers. This data offers valuable insights into their activities, behaviors, and decision-making, helping to improve educational practices and create more effective learning experiences.



EVIDENCEB

The association functions as a collaborative platform for diverse European stakeholders, driving the efficient growth of the data economy. Acting as a "Use Case Factory," it bridges theory and practice while promoting sustainable solutions across sectors such as energy, mobility, circular economy, and digital twin technologies. The community, made up of data enthusiasts and enablers, views a transparent, open, interoperable, and sovereign data economy as essential for fostering a more efficient and sustainable future.



VENTR SOLUTIONS

The company combines the creativity and agility of startups with the stability and resources of established enterprises. Startups play a vital role in driving structural change, especially in Germany, where engineering expertise enhances innovation. By linking the scalability of large corporations with the disruptive ideas of emerging businesses, the company builds bridges between key stakeholders, fostering collaboration and paving the way for future success.



3DS OUTSCALE

3DS OUTSCALE provides robust and secure cloud services on IaaS infrastructures, driving innovation and operational efficiency through virtual twins and protected cloud environments. Its solutions empower businesses, healthcare providers, and public sector organisations to harness data and AI for improved operations and seamless collaboration. With a strong focus on sovereignty, the company ensures full control over sensitive data, delivering advanced cyber governance and cloud solutions that adhere to the highest standards of security and privacy.



CABRILOG

An EdTech company specialising in learning applications designed for over 15,000 K-12 students, offering advanced capabilities in skills matching and learning analytics. The organisation also manages a comprehensive dataset of learning traces (xAPI), enabling detailed insights into student interactions and performance. By leveraging data-driven solutions, the company supports educators and students in achieving personalised and effective learning outcomes.



CONSERVATOIRE NATIONAL DES ARTS ET MÉTIERS

The first platform dedicated to maths and science learning simplifies the creation and assignment of activities while enabling tracking of student progress. Le Cnam, a leading institution, serves three core missions: providing lifelong learning opportunities, fostering excellence in technological research and innovation, and promoting the dissemination of scientific and technical knowledge.

The logo for le cnam, featuring the text "le cnam" in a red, lowercase, sans-serif font.

MIMBUS

Dedicated to developing immersive solutions for training and education, specialising in learning analytics to enhance the effectiveness of digital learning experiences. By leveraging advanced virtual reality (VR) technologies, the company provides innovative tools for skill development and professional training. It also maintains a comprehensive dataset of VR activities, offering valuable insights into user engagement, performance metrics, and behavioural patterns.



UBICAST

UbiCast delivers a seamless and personalised remote learning experience through its intuitive platform for creating multimedia resources. Users can easily produce engaging, interactive video content enriched with advanced social learning features, promoting real-time student interaction and active engagement.



WIDID

This EdTech company offers a Learning Analytics platform focused on Virtual Reality (VR) in the education sector, with a strong emphasis on VR analytics. The platform provides a comprehensive dataset of VR activities, capturing detailed insights such as semantics, prosody, gestures, gazes, and locations, enabling a deeper understanding of learner interactions and engagement in immersive environments.



MASKOTT

Provides an AI-based content recommendation system for teachers, encouraging students to form communities with others who share similar interests. The platform tracks the learning progress of over 1 million students and offers more than 50,000 learning modules and content created by Maskott, fostering personalized and collaborative learning experiences.



ORANGE BUSINESS BELGIUM SA

As a cloud service provider, the company plans to deploy the building blocks on its infrastructure and marketplace, enabling seamless integration and expanded access for users.



UNIVERSITETET I OSLO

The University of Oslo, Norway's oldest and highest-ranked university, boasts more than 26,000 students and 7,000 staff members. It offers a wide range of study programmes, courses, and continuing education opportunities. As a leading institution, it excels in research and significantly contributes to various fields, advancing the academic community both nationally and internationally.



AFFECTLOG

The company's audit platform enhances its functionalities by building on widely adopted industry standards for risk assessment, including OWASP, the UNESCO Recommendation on the Ethics of AI, the draft text of the EU AI Act, and NIST.



DIGITALEUROPE

DIGITALEUROPE is a prominent trade association representing industries in digital transformation across Europe. It advocates for regulations that support European businesses and citizens through digital technologies, with the goal of driving growth and attracting top digital talent globally. With over 45,000 members, including 109 major corporations and 41 national trade associations, DIGITALEUROPE helps shape industry policies and influence EU legislation. Its mission is to create a secure, competitive, and sustainable digital landscape in Europe.



DIGITAL NEW DEAL

The "Digital New Deal" initiative addresses society's digital challenges by simplifying the complexities of digitalisation. This think tank focuses on uncovering key developments in digital transformation, offering guidance to both companies and policymakers. By providing strategic insights and measures, the initiative helps stakeholders navigate the evolving digital landscape, fostering informed decisions that promote innovation and sustainability.



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