

Graph-Massivizer promotes climate-neutral and sustainable economic sectors boosted by graph data processing

April 05, 2023

The [Graph-Massivizer](#) project consortium is happy to announce the official start of this European initiative, funded by the European Commission under the Horizon Europe research and innovation programme. Graph-Massivizer aims at delivering open-source and commercial solutions that drive green digital transformation across use cases in finance, manufacturing, environment protection and exascale computing.

Leveraging graph data through an efficient and scalable digital infrastructure driving green digital transformation

Graphs are data structures that represent real-world and digital objects and their relations. In an increasingly complex world, graphs can be useful to intuitively model and represent complex scenarios and systems such as social or economic networks or digital twins.

Over the last decade, graphs have made great advances in making data findable, accessible, interoperable, and reusable. For many organisations, they have become a key instrument for extracting meaningful insights that support timely, high-impact decisions. On a larger scale, graphs are becoming crucial to innovation, competition, and prosperity. They help derive trustworthy insights to create sustainable communities and support digital transformation with better, more profitable, greener products and services. However, current graph processing platforms come with various limitations, ranging from high energy consumption and inefficiency and lack of support for diverse workloads, models, languages, and algebraic frameworks to the difficulty of use for non-experts.

Graph-Massivizer addresses these challenges by delivering an integrated toolkit to support a climate-neutral and sustainable economy based on graph data. The project partners will develop five open-source software tools for high-performance, scalable, and sustainable graph processing, as well as an enterprise-class commercial version based on the [metaphactory](#) knowledge graph platform that tightly integrates the tools in an easy-to-use-and-deploy offering to reach a broader market share.



Ambitious green use case validation in finance, environment protection, manufacturing, and high-performance computing sectors

To ensure applicability and scalability in real-world scenarios and the feasibility of commercial solutions developed on top of metaphactory as a result of the Graph-Massivizer project, the project partners will validate the innovative toolkit on four use cases that cover the economic, societal and environmental sustainability pillars:

- sustainable green finance,
- global environment protection foresight,
- green artificial intelligence (AI) for the sustainable automotive industry, and
- data centre digital twin for exascale computing.

These use cases tackle extreme data processing and massive graph analytics challenges and are a perfect fit for the Graph-Massivizer toolkit.

Across these use cases, Graph-Massivizer aims to improve analytics efficiency by 70% and energy awareness for extract-transform-load (ETL) storage operations by 30%. Furthermore, it aims to demonstrate a possible two-fold improvement in data centre energy efficiency and over 25% lower greenhouse gas (GHG) emissions for basic graph operations.

“My vision for Graph-Massivizer is to enable a worldwide Sustainability Graph, a universal abstraction that captures, combines, models, analyses and processes knowledge about our economic, societal and environmental world. The project will contribute to this vision by providing a technological solution, coupled with field experiments and experience-sharing for a high-performance and sustainable graph processing of extreme data with a proper response for any need and organisational size by 2030,” commented the project coordinator Radu Prodan from the University of Klagenfurt.

Synthetic Financial Data Multiverse is a solution offered by [Peracton Ltd.](#) that generates fast, affordable and unlimited synthetic financial data sets, eliminating biases and increasing accessibility, overcoming traditional financial data limitations. Peracton leverages this tool for green investment and trading, aiming to reduce risks and improve the performance of financial algorithms. The Synthetic Financial Data Multiverse meets financial industry demands, de-risks algorithmic models, and addresses environmental sustainability.

“In the AI era, when there is never enough data to validate and train AI models, the Synthetic Financial Data Multiverse has the potential to radically transform the generation and use of financial markets data. ‘Real data’ problems such as biases, inaccuracies, historical irrelevance, costs, statistical relevance, overfitting will no longer apply when using bespoke synthetic financial data for testing and validating AI-enhanced financial algorithms,” says Laurentiu Vasiliu, CEO and founder of Peracton Ltd.



Global Foresight is a solution developed by [Event Registry d.o.o.](#) that empowers decision-makers with comprehensive protection insights. It allows them to stay ahead of emerging trends and scenarios and make informed, data-driven policy decisions that positively impact the environment. The solution analyses vast amounts of data from various open web sources to create an intuitive and interactive contextual graph and deliver insights and forecasts of future events.

“Global Foresight strongly emphasises the geopolitical and business aspects of environment, society and governance, providing a 360-degree view of the future landscape. From climate change to resource depletion, the solution tool will deliver comprehensive forecasts and insights to enable proactive policy-making decisions that promote sustainability practices for environmental protection,” says Gregor Leban, CEO and co-founder of Event Registry.

Green Manufacturing Line Diagnose is a solution developed by [Robert Bosch GmbH](#) that captures several value-chain stages to better predict their outcome and detect anomalies in welding control systems essential for many manufacturing processes. Better and quicker analysis prevents defect propagation and unnecessary waste, contributing to a sustainable, circular, and climate-neutral automotive industry.

“By combining graph-based AI methods with digital twins, the tool provides new insights and boosts the efficiency and scalability of the diagnosis beyond that of more expensive alternatives, such as excessive sensor deployment for continuous monitoring. The insights gained will help optimise manufacturing operations and improve the operational quality of the resulting products”, says Evgeny Kharmalov, senior expert at Bosch Center for Artificial Intelligence.

Data Center Digital Twin is a solution developed by [Cineca](#) and the [University of Bologna](#) that provides a virtual representation of the world’s fourth-fastest supercomputer [Leonardo](#). Leonardo’s digital massive graph representation describes complex spatial, semantic, and temporal relationships between the monitoring metrics, hardware nodes, cooling equipment, and software, which are difficult to capture and express otherwise.

“Once operative, Leonardo will generate over 10 million metrics and petabytes of data that require AI analytics on massive graphs to extract operational insights for improved science throughput. The information in such a large volume of data is essential for understanding and optimising the efficiency and sustainability of future modern supercomputers operating at exascale performance,” says Andrea Bartolini, assistant professor at the University of Bologna.

Graph-Massivizer toolkit covering the sustainable lifecycle of processing extreme data as massive graphs

To support these use cases, Graph-Massivizer develops a software platform consisting of five integrated tools for extreme data processing that will:

- translate extreme data streams or follows heuristics to generate synthetic data and persist it within a graph structure.
- use probabilistic reasoning and AI algorithms for graph pattern discovery, low-footprint graph generation, and low latency error-bounded queries.
- help co-design the most promising processing infrastructure with guaranteed performance and energy consumption estimates for specific workloads.
- use operational data centres and national energy supplier data to simulate sustainability profiles for operating graph workload analytics at scale.
- use the performance and sustainability models to deploy and orchestrate the graph analytics workloads on the computing continuum.

About Graph-Massivizer

[Graph-Massivizer](#), a three-year project that started on January 1, 2023, aims to support a climate-neutral and sustainable economy by developing high-performance, scalable, and sustainable graph data processing tools. Led by the University of Klagenfurt and composed of 12 partners from 8 EU countries, the project brings together the world-leading roles of European researchers in graph processing and serverless computing and uses leadership-class European infrastructure in the computing continuum.

Project partners are: [Universität Klagenfurt](#), [IDC4EU](#), [Peracton Ltd.](#), [SINTEF AS](#), [University of Twente](#), [metaphacts GmbH](#), [Vrije Universiteit Amsterdam](#), [Cineca Consortio Interuniversitario](#), [Event Registry](#), [Alma Mater Studiorum - Università di Bologna](#), [Robert BOSCH GmbH](#), [Jozef Stefan Institute](#).

The project is funded by '[Horizon Europe](#)', the European Union's key funding programme for research and innovation. Among many other R&D topics, Horizon Europe tackles climate change and helps to achieve the UN's Sustainable Development Goals. It also aims at boosting the EU's competitiveness and growth.

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