

Introduction to data economy

Data dilemma, Data spaces, Data ecosystems

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About the series

This paper contains the content of the free online course ‘Introduction to data economy: data dilemma, data spaces, data ecosystems’ organised by the Gaia-X Hub Germany. It provides interested parties with a basic understanding of the data economy and promotes discourse and the exchange of ideas.

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2. Data spaces

2.1. Europe's answer to the data age

Data spaces are Europe's innovative answer to the challenges of the digital age. They enable companies and organizations to exchange data confidently and securely. In contrast to centralized platforms, data spaces use a decentralized structure that leaves data owners in control. This concept combines data sovereignty with economic growth and opens up new [opportunities for innovation](#).

2.2. Origin of the data space: a misleading metaphor

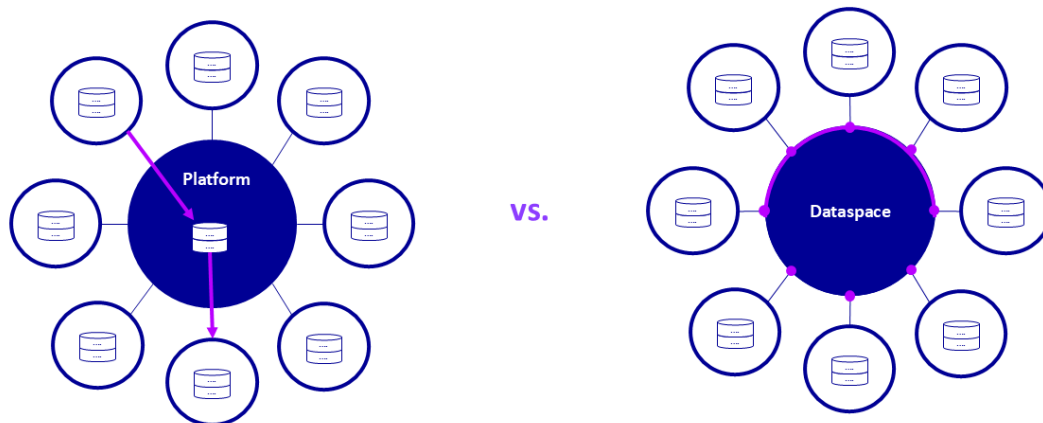
When you think of a "space", you probably imagine a physical place where things are brought together. This idea is slightly misleading when it comes to the term "data space". This is because, unlike a central data platform, data in a digital data space is not collected in one place.

The metaphor of the data space has its roots in the business world: law firms often set up physical data spaces when acquiring companies. Potential investors can view the business books there - but not take them with them. A historical example of this is the secret contract documents of the failed TTIP free trade agreement. They were stored in a physical data space at the Federal Ministry of Economics, accessible only to selected members of parliament.

A digital data space works in a similar way, but virtually: the data remains in the owner's source systems. Third parties access it via a connector - but only under strictly controlled conditions. The owner defines these, using a set of rules such as Gaia-X.

In this way, the data owners retain full control and remain in possession of their data. They only grant access to people or organizations they trust. You could say that a data space is like an Internet with a pass and copy protection.

In dataspace, data is not shared within the dataspace but is directly connected via "edge points".



Source: Gaia-X Hub Germany, 2024

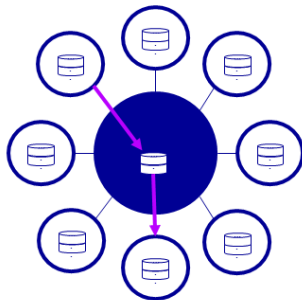
2.3. Digital data spaces as an anti-platform

Let's imagine that the European transport industry is planning a data space for autonomous mobility. It wants to use information from vehicles, smartphones, sensors along the roads, traffic management systems, local public transport, and weather services. The obvious way forward is to collect all relevant data in a central cloud and analyse it there. But what would the consequences be?

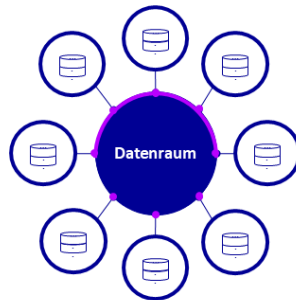
The entire transportation of our continent would depend on a single platform provider. If its headquarters were located in the USA or China, for example, decisions from other jurisdictions and economic regions could directly influence mobility in Europe. Even a European provider could take advantage of economic and technological dependencies. A monopoly with all its damaging consequences would be virtually unavoidable.

A data space takes a different approach: it networks different platforms, data sources, and data services in an ecosystem on a federated infrastructure. Sounds complicated? Let's take a closer look.

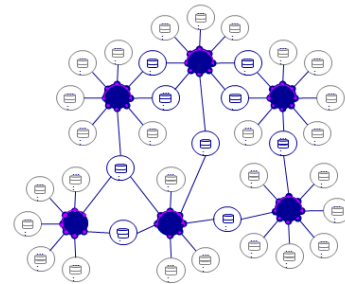
Data Platform



Data Space



Data Ecosystem



Source: Gaia-X Hub Germany, 2025

2.4. Store data decentrally, federate data usage

"Federate" - a favorite word among Europeans, and for good reasons. It comes from the Latin "foedus", which means "alliance" or "treaty". The idea of federalism is deeply rooted in European history.

Europe has always been a patchwork of small and large empires and states, characterized by exchange and competition in a confined space. The simultaneity of competition, mutual observation and inspiration accelerated progress.

Even today, the European Union is not a unified state, but a supranational association that federates state action - i.e. binds and coordinates it through alliances, treaties and procedures for legislation, jurisdiction, and administration. In other words: Europe is not a state, but a network with fixed nodes and edges.

In the context of IT, "federating" means the networking and collaboration of distributed systems. For a pan-European data infrastructure, the idea of a network is therefore more appropriate than that of a central platform. It reflects the historical DNA of our continent.

Collaboration is the key to digital growth

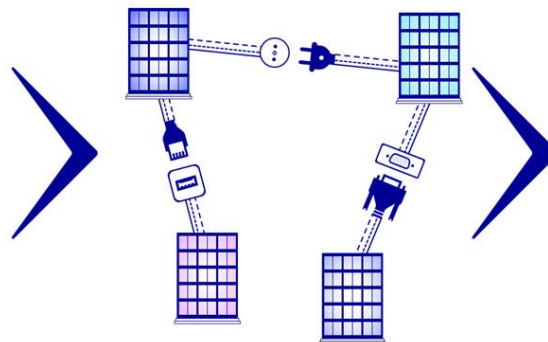
PREVIOUSLY: Data silos

- Data potential unused
- No cross-connections



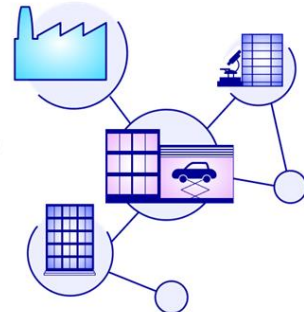
NOW: Data Sharing

- Single connections
- Proprietary standards



FUTURE: Data Economy

- Common rules and uniform standards
- Data sovereignty for diverse participants from different sectors



Source: Gaia-X Hub Germany, 2025

2.5. Example: Data-driven mobility for Europe

Let's look again at the example of a data space for mobility in Europe. With a central platform solution, all traffic data - from road conditions and vehicle movements to user behavior - would be stored in a single cloud. This would create enormous security risks and dependencies.

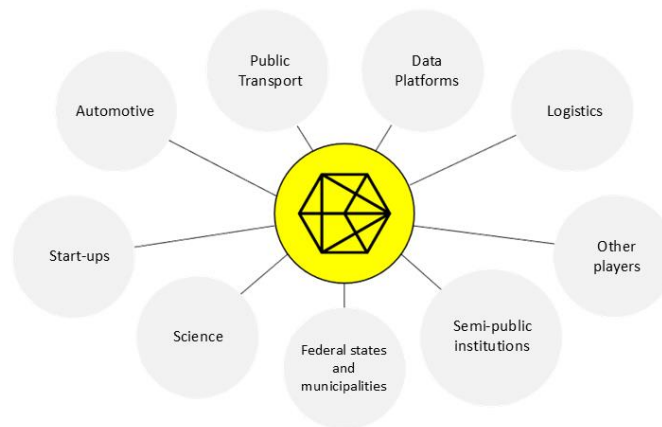
In a data space, on the other hand, the data remains decentralized:

- Cities retain control over their traffic management systems.
- Automotive companies manage the data of their connected vehicles.
- Map services pass on their current road information.

The data space allows all participants to exchange and link their data in a controlled manner, while at the same time everyone retains full sovereignty over their data. This allows innovative mobility services to be created without a single player controlling all the data.

2.6. Sketch: How does a data space work?

Let's stay with the example of transport - here the [Mobility Data Space \(MDS\)](#) shows in concrete terms how a European data space already works today, and which players are participating in it.



Source: DRM Datenraum Mobilität GmbH, 2023

Members of the MDS are:

- Automotive companies (e.g. vehicle position data, battery status)
- Cities/municipalities (e.g. real-time data on road conditions, construction sites, parking space)
- Weather services (e.g. storm reports, black ice forecasts)
- Insurance groups (e.g. accident statistics, risk profiles)
- Charging infrastructure operators (e.g. availability, charging speeds)

2.7. The key mechanisms for sovereign data exchange between these players are as follows:

1. Decentralized architecture

The data of these players remains in their source systems - a traffic authority does not store its traffic light circuits in the Mobility Data Space but keeps them on its own premises and grants access as required via a connector.

2. Automated Trust

Data spaces use mechanisms for automated identity and compliance management to ensure trust and interoperability. For example, the MDS uses a service called Dynamic Attribute Provisioning Service. The DAPS works like a digital ID stamp that provides data connections with up-to-date information to enable secure data exchange.

Other data spaces rely on the service of the [Gaia-X Digital Clearing Houses \(GXDCH\)](#). The GXDCH function like a bouncer for the entire Gaia-X network, checking whether participants and their offers comply with the rules and fit into the ecosystem. To participate in the data space, an organization must identify and legitimize itself to a GXDCH in a multi-stage process. At the end of this process, the GXDC issues a digital certificate that confirms an organization's or service's compliance with the Gaia-X standards.

3. Terms of use

A participant in the Mobility Data Space, for example an automotive group, ties access to its data to the following conditions:

- Access only for real-time route optimization
- No storage of data after use
- Exclusion of competitor companies X ,Y ,Z

4. Neutral hosting organization

In 2021, the hosting organization of the Mobility Data Space, the “DRM Datenraum Mobilität GmbH”, was founded. It is structured as a neutral non-profit organization and has the task of further developing the Mobility Data Space and orchestrating it technically and commercially. acatech - the National Academy of Science and Engineering is the majority shareholder and thus acts as a neutral mediator.

2.8. Practical benefits

Thanks to these mechanisms, practical use cases are being developed for various players in the Mobility Data Space. For example, a logistics company uses the MDS for:

- Weather forecasts from weather services
- Road closures in the city
- Charging capacities of infrastructure providers
- Live positions of their own e-trucks

The result: fewer empty runs and lower energy consumption - without a company controlling the data.

This example shows: data spaces don't just solve technical problems. They are a socio-

technical ecosystem that creates trust through clear rules and transparency and enables innovation and economic growth.

2.9. Growing economic importance of data spaces

The development of data spaces is not only a technological necessity, but also of enormous economic importance. Some figures and assessments from experts illustrate this:

1. A [study by Capgemini](#) expects data ecosystems to deliver significant performance improvements for companies: 15% more customer satisfaction, 14% more productivity/efficiency, 11% lower annual costs for 2-3 years
2. By applying the Data Act, [the EU Commission expects an increase in GDP](#) in the member states of 270 billion euros by 2028.
3. A [Bitkom survey](#) from 2024 shows that 61% of German companies are barely or not at all exploiting their data potential. Data spaces could help to leverage this huge potential.
4. According to the [German Economic Institute \(IW\)](#), new business models and products are often only possible if companies not only use their own data, but can also incorporate data from other organisations. This is why data sharing is now central to the future viability of companies.

These facts show how urgent and promising the development of data spaces is. Europe must act if it does not want to fall behind in global competition.

Data spaces create a solution that promotes economic growth and secures digital sovereignty. They are Europe's answer to the challenges of the data age - an answer that preserves our values and federal structure.

In the following chapters, we will look at how Gaia-X is realizing this vision and what concrete steps companies can take to benefit from it.

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