Gaia-X Digital Clearing Houses (GXDCH)

Gatekeeper of the data economy

By Thomas Sprenger

At the heart of Gaia-X is the idea that people and organisations in the data economy should retain control over their data. But who monitors whether everyone is playing by the rules? In data ecosystems based on Gaia-X, this task is performed by the Gaia-X Digital Clearing Houses (GXDCH). They are intended to strengthen trust in digital cooperation within supply chains and industries. An overview.

A research institute wants to use anonymised health data from smartwatches for a study. The scientists hope to obtain this data via a health data room such as HEALTH-X dataLOFT.

But who guarantees the researchers that the data room does not undermine minimum standards for data sovereignty and data protection? And how do the operators of the data room know that it is actually the research institute in question?

Sharing data with the handbrake on

Until now, business and science have regulated data-based collaboration through individual contracts between business partners. This means that the research institute has to define system requirements, data formats, types of use and access rights in detail in individual contracts with all partners with whom it wishes to exchange data. When it comes to hardware and software manufacturers and users of smartwatches, things quickly become confusing.

In addition, there is the programming and program maintenance of proprietary interfaces at each end point of a data exchange. This makes changing or adding new partners cumbersome and time-consuming. An agile data economy with freedom of choice and free competition thus remains unattainable.

No cooperation without trust

Initiatives such as Gaia-X, the International Data Spaces Association (IDSA) and the Data Spaces Support Center (DSCC) are countering such solo efforts and individual solutions with an ecosystem of interoperable data spaces with cross-sector rules, standards, procedures and open-source technology that can be used by all sectors equally.

The idea: Before the data silos of traditional industries open up and digital value creation flourishes across organisational boundaries, data-based cooperation must also be possible between anonymous third parties in a legally secure and trustworthy manner. This is not possible without trust.

What are Gaia-X Digital Clearing Houses?

Trust is therefore the prerequisite for a fair data economy and for the promise of data sovereignty, transparency and interoperability that Gaia-X stands for. Companies and people only share their data if they can expect other players to respect the rules.

However, the mere assertion of compliance and subsequent sanctions against any violations alone do not justify such trust in the system. Control is needed - and this is where the Gaia-X Digital Clearing Houses (GXDCH) come into play.

The GXDCHs serve as clearing houses for all Gaia-X data rooms. They check who is allowed to be part of Gaia-X. To this end, they certify the Gaia-X conformity of participants and services based on the specifications of the Gaia-X Framework.

But where can we find these clearing houses?

At least not in Brussels' Avenue des Arts, in the heart of the European Quarter. This is where the Gaia-X European Association for Data and Cloud AISBL (Gaia-X AISBL) sets the framework conditions for the European data ecosystem through the Gaia-X Framework and Policy Rules. However, the Gaia-X central association does not want to operate the future clearing houses for the initiative. For good reason.

The ability to check Gaia-X compliance must scale with the growth of data rooms. This is why external service providers take on this task under market conditions. They operate all the Gaia-X framework services necessary to achieve compliance and support the inclusion of Gaia-X participants.

Currently, four ICT providers have launched their first clearing houses: Aruba in Italy, T-Systems in Germany and Aire Networks and Arsys in Spain. In addition, the Gaia-X Association is offering

its own clearing house as a test environment. The two French infrastructure and service providers OVH and Exaion have also agreed to operate clearing houses. Orange, Proximus, A1.digital, KPN and Pfalzkom have announced the establishment of further GXDCHs.

What do the GXDCH offer?

The clearing houses offer various components: The Gaia-X Central Association obliges the operators to provide the basic functions for checking conformity free of charge. The range of services offered by the clearing houses therefore consists of mandatory (free of charge) and optional (possibly chargeable) services. Each GXDCH offers programming interfaces (APIs) for the mandatory services, which can be found on an overview page of the AISBL.

Mandatory, free components

1. **Gaia-X Compliance Service:** This basic component checks compliance with the Gaia-X standards. It validates the Verifiable Presentations (VP) submitted by participants and issues a Gaia-X Verifiable Credential (VC) if the check is positive.
   Explanation: A Verifiable Credential is a digital proof that verifies the identity or qualifications of a person or organisation. VCs use cryptographic mechanisms to ensure that the information they contain is authentic and tamper-proof. They are comparable to digital passports that confirm certain information securely and unalterably.
   A verifiable presentation is a structured representation of one or more verifiable credentials. It enables VC to be linked and selected information to be presented as required without disclosing all the data it contains.
2. **Gaia-X Registry:** This registry manages a list of trustworthy issuers (trust anchors) of electronic credentials. The registry also defines how credentials must be structured.
3. **Gaia-X Notarization Services:** This basic service ensures that no one moves around the Gaia-X ecosystem with a false or stolen company identity. To do this, the service checks their validity (e.g. using the commercial register number) and issues corresponding verifiable credentials.
4. **Credential Event Service:** provides a distributed storage solution for Gaia-X compliant VC. It synchronizes credential IDs between the federated catalogs that publish Gaia-X compliant services.
5. **InterPlanetary File system node:** synchronizes the information between the GXDCH instances, especially that provided by the Gaia-X registry.

6. **Logging service:** Customers do not necessarily have access to this logging service. It is primarily aimed at federators, a kind of coordinating organiser in a data room.

Optional and possibly chargeable components

Furthermore, each GXDCH operator may also offer additional services that facilitate access to Gaia-X or increase convenience. These optional components may be subject to a charge, as they go beyond the basic functionality and offer added value for special user groups.

1. **Wizard/User Interface:** Graphical interfaces and wizard to sign and deploy a combination of VC for a VP.
2. **Catalog:** Filter for federated catalogs to select and find relevant Gaia-X services.
3. **Wallet:** Digital wallet for the secure storage and management of VC.
4. **Key Management System:** To help its customers manage cryptographic material, this service offers support for revocation, key rotation and key recovery.
5. **Policy Decision Point (PDP):** This service draws conclusions from one or more policies and input data. The PDP supports different policy languages. For each policy in a Gaia-X credential, the owner can specify a list of PDP service endpoints that are used to calculate the policies.
6. **Data Exchange Services**

Why the difference between mandatory and optional components?

The distinction between mandatory and optional components serves several purposes:

1. **Accessibility:** The free basic services ensure that all participants can use basic Gaia-X functions. This is intended to create a low-threshold offering that makes it easier for small and medium-sized companies in particular to get started. This is in line with Gaia-X's aim of making data-based collaborations feasible for companies without an IT focus.
2. **Flexibility:** Optional services enable GXDCH operators to respond to the specific needs of different user groups, for example for individual industries.
3. **Innovation:** The ability to offer individual additional services is also intended to promote innovation and competition in the Gaia-X ecosystem and thus increase freedom of choice for participants.
4. **Sustainability:** The option to offer extended services for a fee supports a sustainable business model for GXDCH providers. Ultimately, the operation of a shared data

infrastructure and its essential services must be self-sustaining.

"ClearingHouses.provide(ConformityCheckServices)"

The concept of scalability and accessibility also means that clearing houses are designed as commodities: The free basic services of the various providers are standardised. The clearing houses act as non-exclusive and interchangeable nodes in the data ecosystem. This means that participants can easily change their GXDCH provider or even obtain verification services from different clearing houses at the same time.

The Gaia-X AISBL supports this with the so-called load balancer for GXDCH: This enables participants to automatically assign orders to different GXDCH nodes and thus distribute the job load evenly.

Participants in data rooms benefit from the load balancer in several ways:

1. **Redundancy:** Users can rely on a constant URI (Uniform Resource Identifier) without being tied to a specific GXDCH. A URI is a standardized character string that is used to uniquely address a resource on the Internet. This approach increases the availability and reliability of clearing house services.
2. **Flexibility:** With the automation provided by the load balancer, the basic services of the GXDCH finally become an interchangeable and combinable commodity. They offer basic conformity from the socket, so to speak, and therefore maximum flexibility.
3. **Efficiency:** The even distribution of test jobs also ensures shorter processing times and relieves the burden on individual nodes.

GXDCH's commodity strategy supports an open, fair and efficient ecosystem for data exchange in Europe, while ensuring accessibility and interoperability. The different compliance levels of GXDCH reflect the different needs of participants, depending on the industry or sensitivity of the shared data.

Conformity level and label

The GXDCH certify four different levels of conformity, which reflect the degree of compliance with the Gaia-X standards. These levels are represented by so-called "labels". This allows participants to adapt the level of security and confidence to their specific requirements.

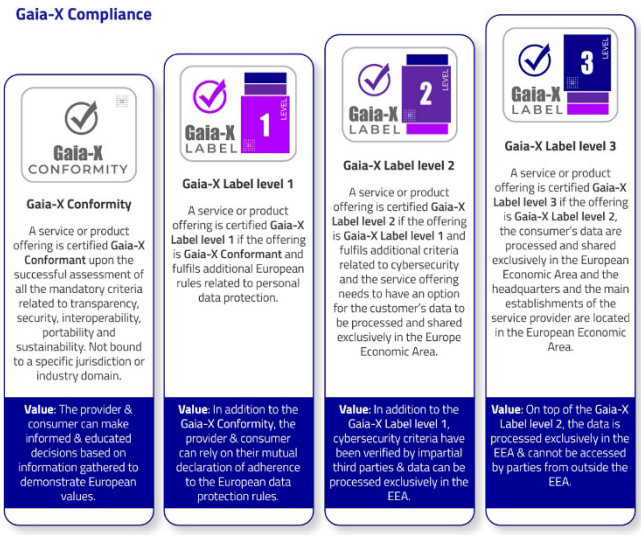

Fig.: Gaia-X Conformity Label, source: Gaia-X European Association for Data and Cloud AISBL

Gaia-X Conformity (basic conformity)

The "Gaia-X Conformity" label is the entry point for participation in the Gaia-X ecosystem and represents the basic level of conformity. It ensures that a service fulfills basic Gaia-X requirements.

The requirements include, for example, a self-description of the service that is signed using a verified method (eIDAS, for example). eIDAS stands for "electronic IDentification, Authentication and trust Services" and is a European Union regulation that creates a uniform legal framework for electronic identification and trust services.

Gaia-X Label 1

Level 1 extends the basic conformity with additional requirements and offers increased security and transparency for users. It includes a certified label logo and ensures data protection in accordance with EU legislation. Cybersecurity must meet the basic level of the certification framework set by the European Union Agency for Cybersecurity (ENISA). The GXDCH validate both the basic compliance and the Gaia-X Label 1 fully automatically.

Gaia-X Label 2

Level 2 builds on Label 1 and tightens the requirements through manual verification and higher cyber security standards. An important aspect is the option to process and share customer data

exclusively in the European Economic Area. This offers additional guarantees for data protection and security.

Gaia-X Label 3

Level 3 places the highest demands on data protection, security and transparency. At this level, the certified service must be based in the EU and the data must be processed exclusively within the European Economic Area. In addition, the cyber security standards must reach the high level of the ENISA standard. This level offers maximum control and security for sensitive data and applications.

How does the testing process work?

The verification of Gaia-X conformity by the clearing houses is a process that differs depending on the level of conformity. It is based on the central association's policy documents (left-hand column in the diagram). They specify 65 criteria (as of August 2024) that the GXDCHs apply and check at the various conformity levels.

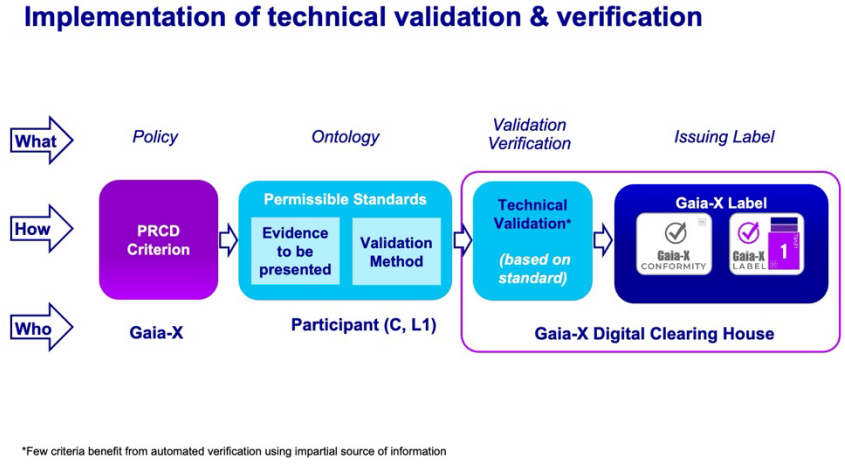

Fig.: Test procedure for basic conformity and Level 1, source: Gaia-X European Association for Data and Cloud AISBL

The second part comprises the so-called ontology (diagram in the middle column). It defines which standards and formats the GXDCH accepts as part of the validation process. The ontology thus plays a central role in the technical implementation of the validation and certification process in Gaia-X by providing a common language and structure for the description and verification of conformity criteria. It also forms the prerequisite for an automated check of conformity with the Gaia-X standards.

The last part (diagram in the right-hand column) represents the operational work of the GXDCH: There is a striking difference here between the first two conformity levels and the more demanding labels of levels 2 and 3: Up to and including Gaia-X Label 1, the GXDCH do not check the actual truthfulness of self-claims made by participants and service providers. They only check whether the form of the statement is plausible, for example whether a given e-mail address

corresponds to the usual format. Experts refer to this as validation as opposed to verification. The aim is to automate the basic conformity and level 1 checks and to keep the hurdles for beginners as low as possible.

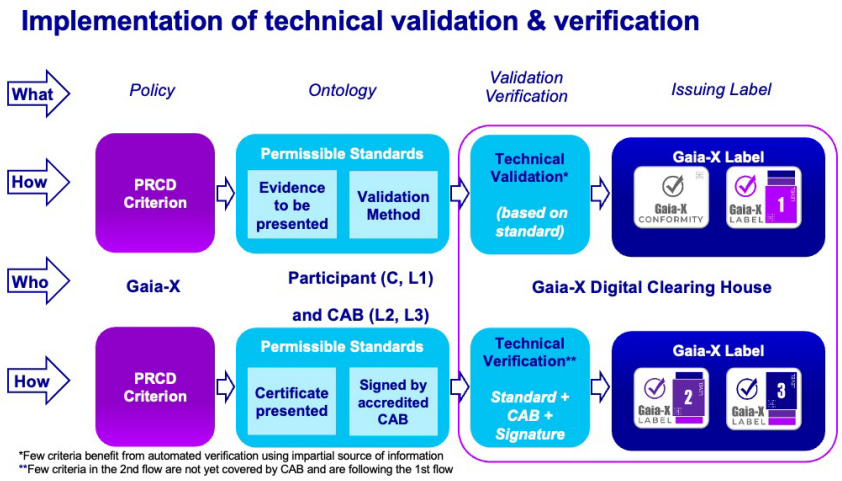

Fig.: Test procedure for the Gaia-X label 2 and 3, source: Gaia-X European Association for Data and Cloud AISBL

From level 2 onwards, the GXDCH checks are stricter: they now rely on manual checks by Conformity Assessment Bodies (CAB) or Trust Anchors in the process instead of just formally checking statements for plausibility. These are trustworthy third parties who confirm the accuracy of statements. Trust anchors can be, for example, government-recognized bodies or certification authorities that are considered reliable sources for certain areas.

The role of trust anchors can be compared to the video identification procedure used when we open a bank account online: Here, a service provider verifies a person's identity on behalf of the bank by means of video transmission and showing the ID card on the screen. The ID card acts as a trust anchor - a trustworthy document issued by the state.

The employee in the Video-Ident procedure verifies the identity by comparing the document shown with the person on the video screen and examining it for security features. Although the procedure itself cannot establish the absolute truth of the identity, it is based on a certified document and can therefore check the plausible match with the ID presented.

The GXDCHs act in a similar way: they check the plausibility of the evidence submitted by checking its formal correctness and additionally relying on confirmation from recognized trust anchors.

The process then runs as follows:

1. A player wants to join a Gaia-X-compliant ecosystem and needs a VC to do so.
2. The actor receives proof of the statement to be verified from a Trust Anchor (e.g. an eIDAS certificate to confirm identity).
3. The statement, proof and other parameters are sent to a GXDCH.
4. The GXDCH validates or verifies the proof of the trust anchor without checking the truth of the statement itself.
5. If the test is positive, the GXDCH issues a Gaia-X VC.

Conclusion

The Gaia-X Digital Clearing Houses (GXDCH) play a crucial role in building trust in the collaborative data economy. The example of the research institute mentioned at the beginning, which wants to use anonymized health data from smartwatches, illustrates the added value: the GXDCHs check whether the services of the health data room comply with the Gaia-X standards for data sovereignty and data protection. At the same time, they ensure the identity of the research institute. Thanks to standardized test procedures, various compliance levels with a free entry label and their commodity approach, the GXDCHs enable secure, flexible data cooperation that can be expanded at any time. They thus form the foundation for an open, fair and efficient data ecosystem in Europe, which makes it easier for SMEs in particular to enter the data economy.

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