



Data Spaces for the Development of Robotics: The PLIADES paradigm



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WS#43 Data Spaces for the development of AI and robotic applications



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Dataspace Benefits

International Data Spaces			
Layers	Perspectives		
Business	Security	Certification	Governance
Functional			
Process			
Information			
System			



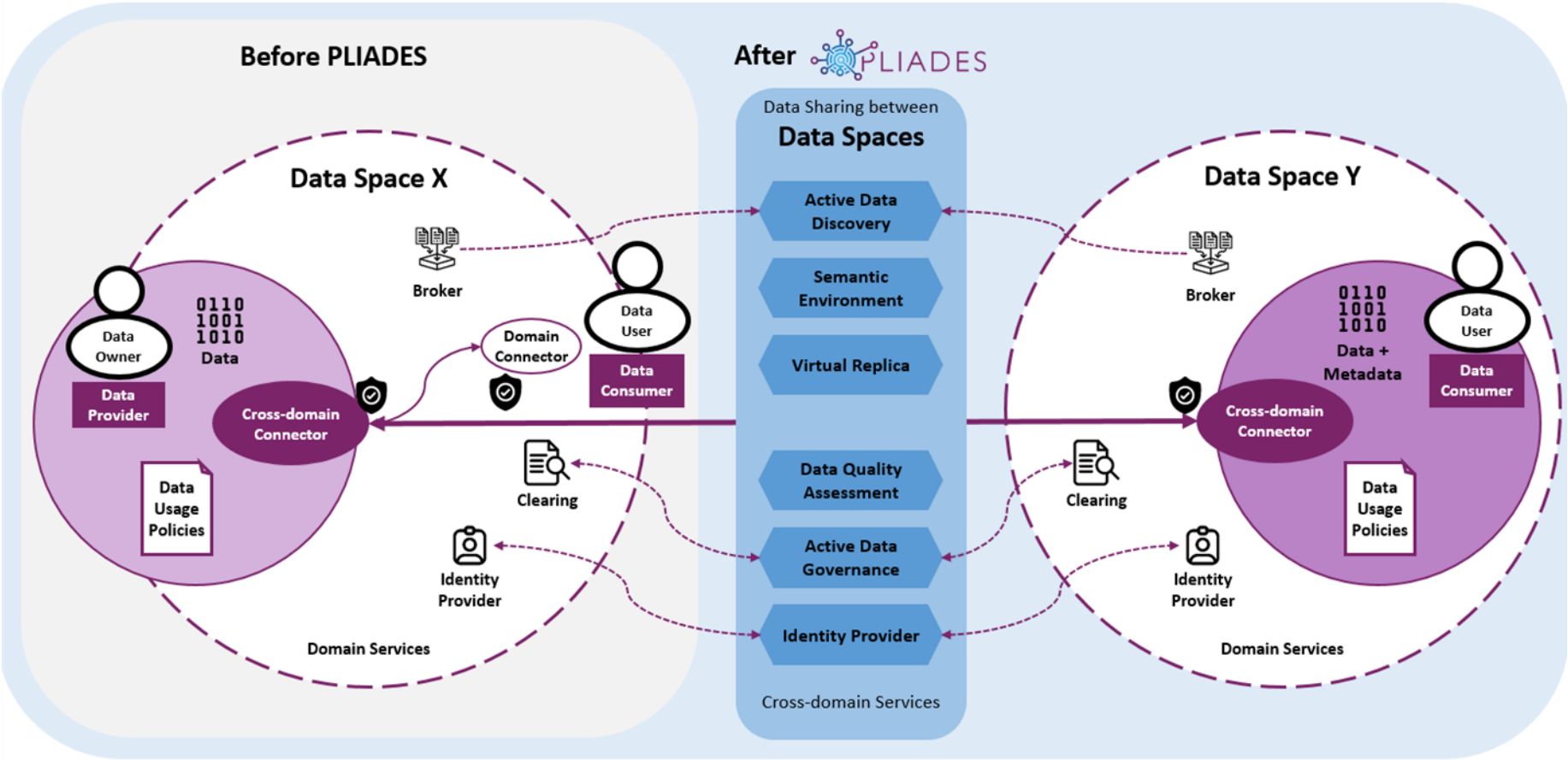
• In General

- Comprehensive Data Governance and Management
- Secure and Privacy-preserving Data Exchange
- Empower data holders to make their data available for reuse for free or against compensation
- Data consumers can discover and incorporate third-party data (from different suppliers) into their systems

• In AI and Robotics

- Enable GenAI to access diverse, domain-specific (including industrial) datasets
- Facilitates compliance with legal and regulatory frameworks
- Enable mixing federated machine learning approaches with privacy-preserving technologies (e.g. in industrial automation)
- Addresses entire data life-cycle from data creation, to processing, to reuse, to destruction

PLIADES AI-boosterd cross-domain approach to dataspace



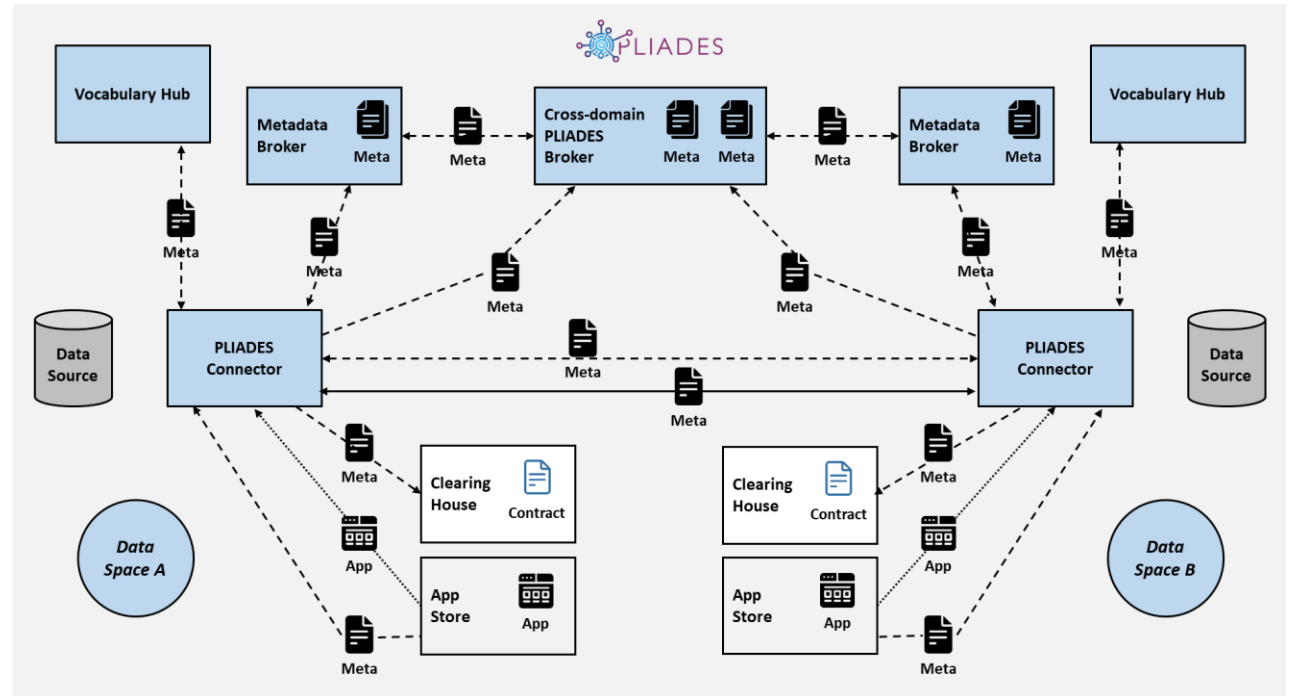
Extending the IDSA-RAM to facilitate cross-domain interoperability

- PLIADES AI Connector

- enables seamless operation across **multiple** data spaces
- supports **decentralized** data **transformation** and **analysis**
- ensures **privacy-preserving** and **secure** data **sharing**

- PLIADES AI-boosted Broker

- recommends the optimal **matching** between **datasets** and data **consumers**
- facilitates **cross-domain** data **discovery**
- integrate **recommendation engines**, **ranking systems**, and AI-enabled **declarative querying**



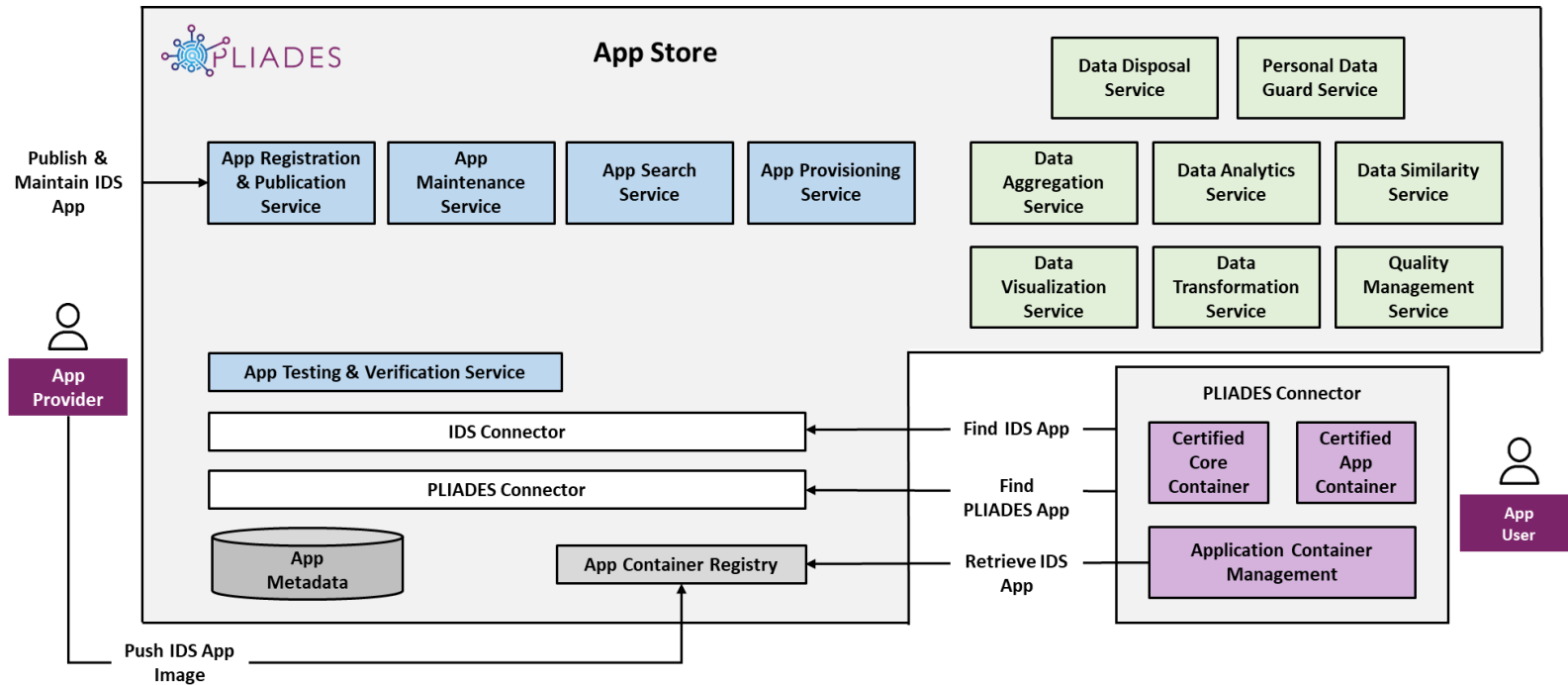


PLIADES Platform Nodes for Machine Learning Operations

- **Active Learning node**: provides a mechanism to inject human knowledge into the process of data annotation and metadata creation
- **Generative AI node**: generates artificial data from raw ones, aiming to the creation of federated Digital Twin models that will represent different domains
- **Explainable Model Creation node**: uses as input multimodal data, such as images, LiDAR, real-time analytics, etc., real or artificial, in order to develop and validate explainable AI models
- **Data Drift node**: receives as input multimodal data, such as images, LiDAR, real-time analytics, etc., compares distributions of existing data and new incoming data and notifies alerts when data distributions are too different
- **Federated Learning (FL) node**: enables massive FL applications to run simultaneously on edge networks
 - Peer-to-Peer (P2P) model to re-architect the centralized FL system design into fully decentralized



PLIADES Unlocks more Dataspace Benefits for AI and Robotics



- **PLIADES Dataspace Apps and Services**

- **Data Aggregation App:** Allows the connection to multiple sources of data to retrieve the information out of it to later transform it (Data Transformation App) if it is necessary
- **Data Transformation App:** Automatically detect and correct data quality issues, including missing values, duplicates, and inconsistencies
- **Data Analytics App:** Involves extracting insights out of the data obtained from the Aggregation/Transformation Apps
- **Data Visualization App:** Allows to inspect the composed analytics

Validating PLIADES approach with real-world Robotic Use-cases



- Integrating data life cycles of service robot to improve HRI with end users ([Healthcare Data Space](#))

- HRI in rehabilitation
- HRI in patient monitoring



- Integrating data life cycles of smart vehicles for CCAM ([Mobility Data Space](#))

- AI-based ADAS development
- AI-based traffic management



- Integrating professional service robot data life cycles to improve HRI with robot operators ([Healthcare and Industrial Data Spaces](#))

- HRI in telepresence robot operation
- HRI in rehabilitation robot operation
- HRI in manufacturing inspection robot operation



Conclusion

- AI and Robotics stakeholders can leverage Data Spaces as
 - data providers
 - data consumers
 - Dataspace App/Service providers
- PLIADES AI-boosted and cross-domain approach to Data Spaces makes them even more beneficial for AI and Robotics applications
 - more feedback as PLIADES Use-cases' deployment and evaluation progress



Thank you for your attention!

Any Questions?



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