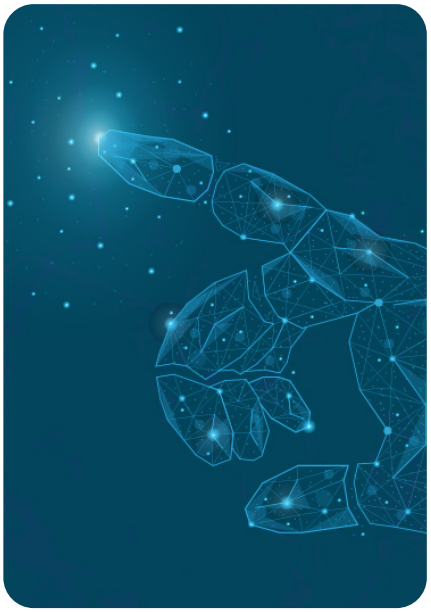
XMANAI
MAKING AI UNDERSTANDABLE

Newsletter #3
July 2022

Moving from 'black box' to 'glass box' Artificial Intelligence in Manufacturing

The Value of Meaningful Data



The infusion of AI processes into manufacturing offers many benefits. It will fuel the development of novel industrial processes for both existing and emerging industries, enhanced production efficiencies with less downtime, and a redefinition of the role of industry workers as they collaborate with and supervise AI-powered co-workers.

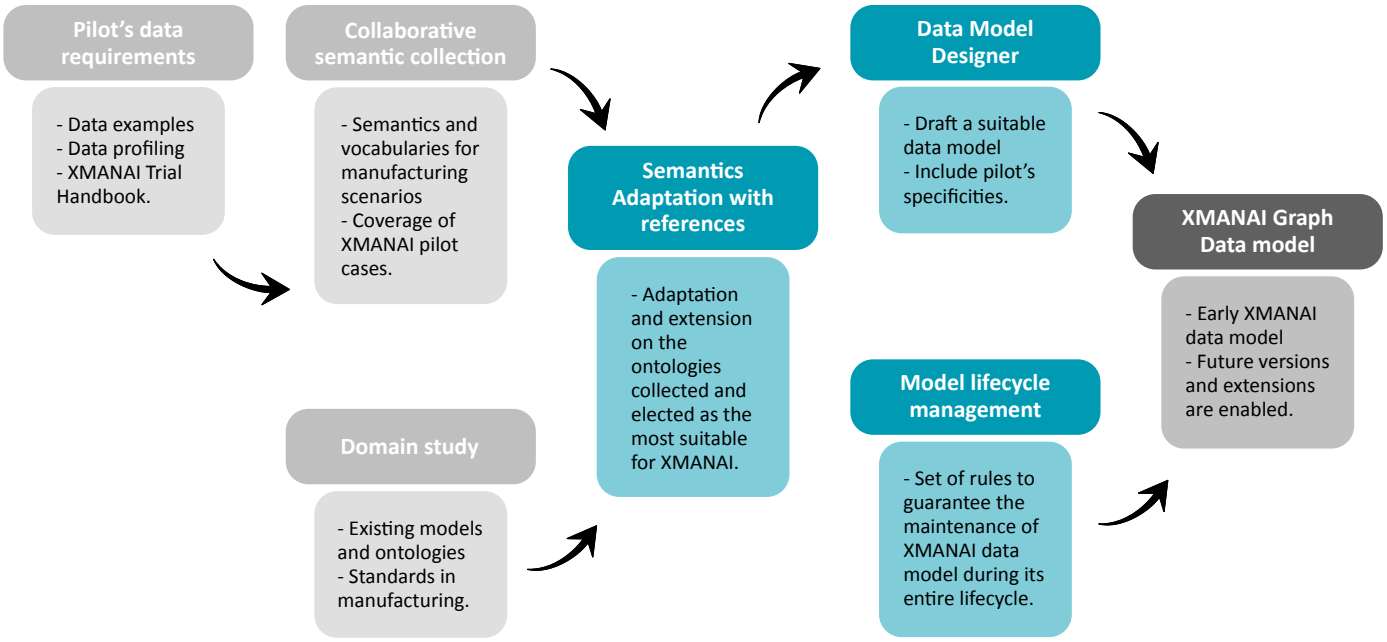
As addressed in the European strategy for data , currently European society is not providing enough meaningful data for the development of AI. This is an indisputable requirement to create insightful AI pipelines less prone to errors.

XMANAI will leverage data models almost across all steps of its AI pipelines. It will use a common data model to support the data ingestion process and allow stakeholders to provide insightful knowledge in an asynchronous manner. The idea is that semantics stay with the data, facilitating understanding for the data scientists even in the first steps of exploration, in activities such as:

- Spotting anomalies in the data,
- Developing an intuition as to the expected distributions,
- Creating meaningful visualisations,
- Anticipating required transformations and useful combinations.

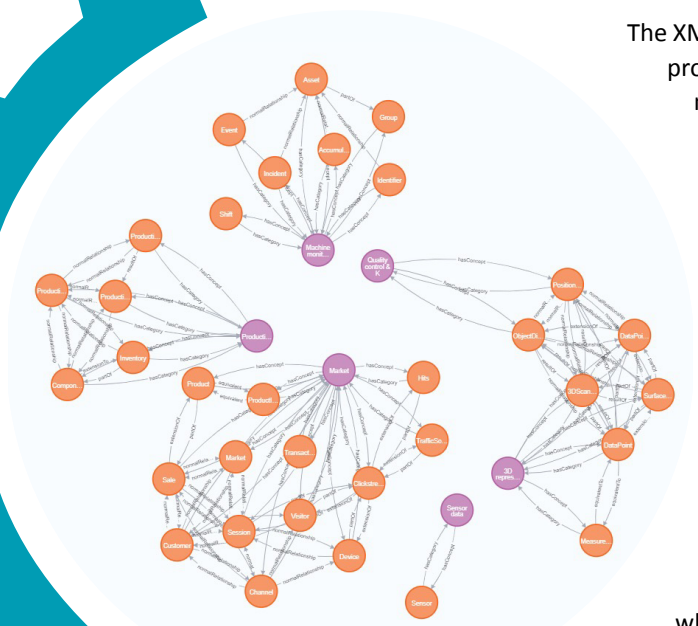
Towards a Common Data Model

A common data model defines the way data can be organized. It ensures data compatibility and consistency across the whole system. Using Graph Database technology, in particular the Labelled Property Graph style, XMANAI is ensuring flexible relationships between data points in opposition to one attained through relational databases. The process to build the XMANAI common data model followed the seven steps illustrated in the figure.



XMANAI Data Model Methodology

XMANAI Graph Data Model



The XMANAI graph data model describes the nodes, properties of nodes and relationships between nodes. The nodes are based on concepts that can represent some object or notion that reflects reality in a digital form. They contain different properties to attempt to mirror the concept that will be stored in the model, from shape and size, to scheduling times or productivity metrics, just to name a few. The nodes and their properties are created from a conceptual structure defined in the graph data model, the category.

Much like in the physical world, concepts can interact with one another, and therefore there must be a way through which relationships are created. For instance, if a machine in a production line is producing a certain object, this object has to have a path to reach a consumer. This interaction may involve many steps and imply that there is a relationship between the machine node (and the production line it belongs) and a distribution system node, describing how one feeds the other.

A relationship can be defined by 5 types:

- normalRelationship: concepts that are related by properties.
- equivalent: one concept is equal to the other.
- partOf: one concept is a subset of the other.
- extensionOf: one concept is a superset of the other.
- resultOf: one concept is a result of the other

Each Relationship contains further descriptors to better define how two concepts interact with each other and can also be defined with properties depending on the context where they are represented.

Being the Data Model a tool to be expanded with more knowledge regarding the environments where it wants to be implemented, the community can contribute to that expansion through http://xmanaikbz.ddns.net/

XMANAI - Explainable Manufacturing Artificial Intelligence

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