Ontology-based Maintenance

Use Case No 9

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- The National Research Council (CNR) is the largest public research institution in Italy (~8.000 employees). Founded in 1923, its mission is to perform research, promote innovation and internationalization, provide technologies and solutions to emerging public and private needs.

- The Institute for Cognitive Sciences and Technologies (ISTC), part of CNR, is an **interdisciplinary** institute working on areas like: Artificial intelligence and techno-social systems; Cognitive, communicative and linguistic processes; Quality of the environment, health and society; etc.

- The Laboratory for Applied Ontology (LOA), part of ISTC, performs basic and applied research on the ontological foundations of conceptual modeling, exploring the role of ontologies and ontology management in fields such as: knowledge representation, knowledge engineering, conceptual modeling, information retrieval, natural language processing, and the semantic web. On the application side, special emphasis is given to the use of ontologies for enterprise and business modeling, product and process modeling, e-government, natural language processing, and the Semantic Web.

Adige S.p.A., BLMGROUP

- Adige S.p.A. is an Italian company and part of the BLM Group, an industrial group specialized in designing, producing, selling and maintaining industrial equipment for working on metal tubes and profiles. BLM Group is a global partner for the **whole tube processing life cycle**, from laser cutting to cold saw, bending, end-forming, and measurement, with a worldwide presence. This wide range of solutions is manufactured in dedicated production sites, with highest expertise and skill levels, established in more than 50 year work and experience in the tube processing technology, with thousands applications all over the world. Within BLM Group, Adige produces **laser cutting systems and machines for disc-cutting** tubes, solid pieces and sections. Adige develops internally also the software suite deployed with its machines. Adige serves more than **40 industrialized countries**, many of them via devoted service agents and offices, with multiple organization models and documentation tools.

- For an example of the machines produced by Adige S.p.A. see: https://www.youtube.com/watch?v=gyhOlvnfD5M&pbjreload=10

Adige machines
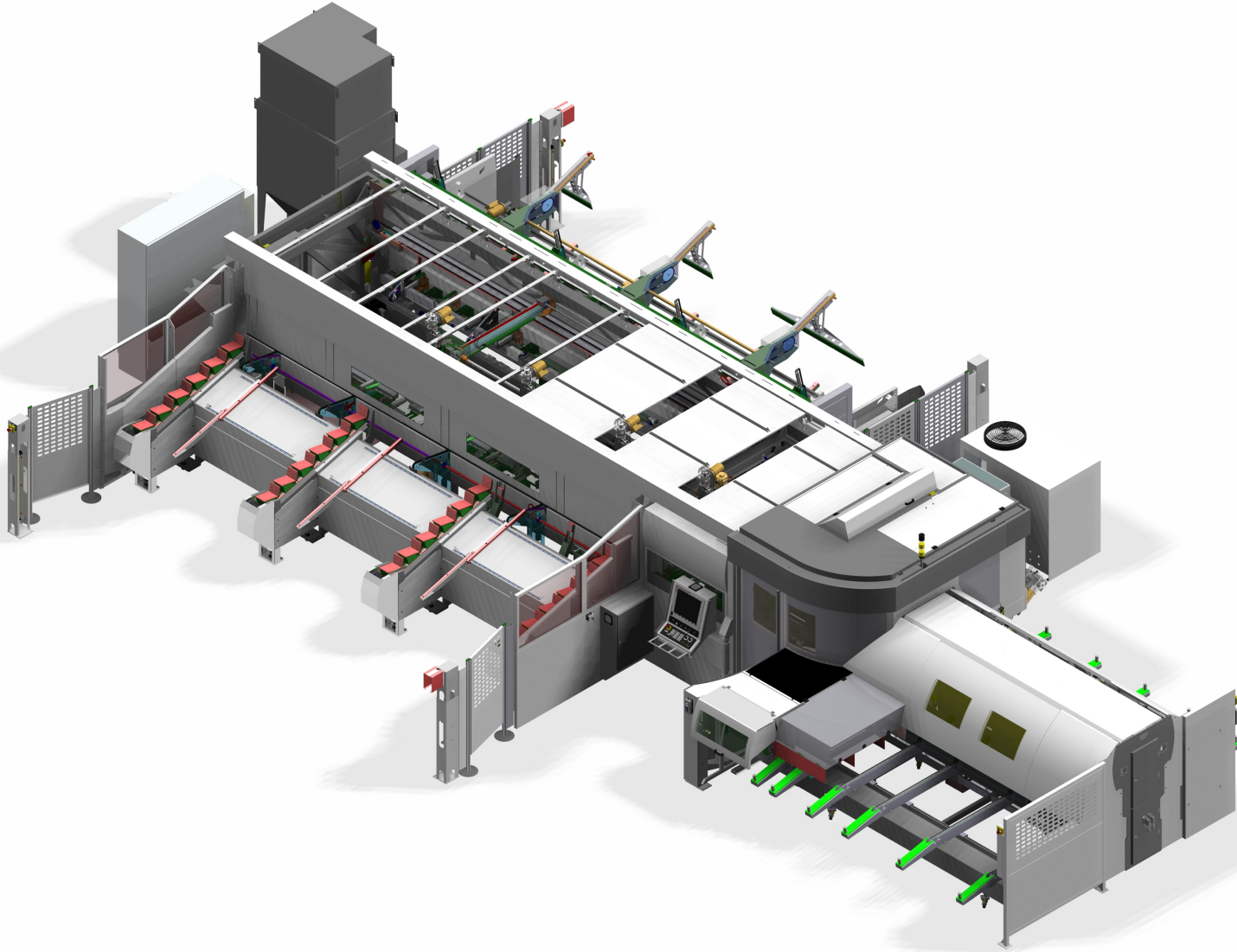
Use case 9: Ontology-based Maintenance

● —The project includes the development of a **repair and diagnosis ontology-based glossary** for the repair and diagnosis process of laser cutting machines, and an analysis of the ways an ontology, properly integrated within the **broader service management system**, may reduce the costs and increase the quality of the maintenance processes. In particular, the aim is to cover terms related to the **machine's parts and structure, design, functions and malfunctions**, as well as terms denoting **service activities** such as inspection, measurement, diagnosis, repair, parts replacement, and spare parts management.

● —Involved roles in the company:

IT personnel

Maintenance Technician

Knowledge engineer

Design engineer
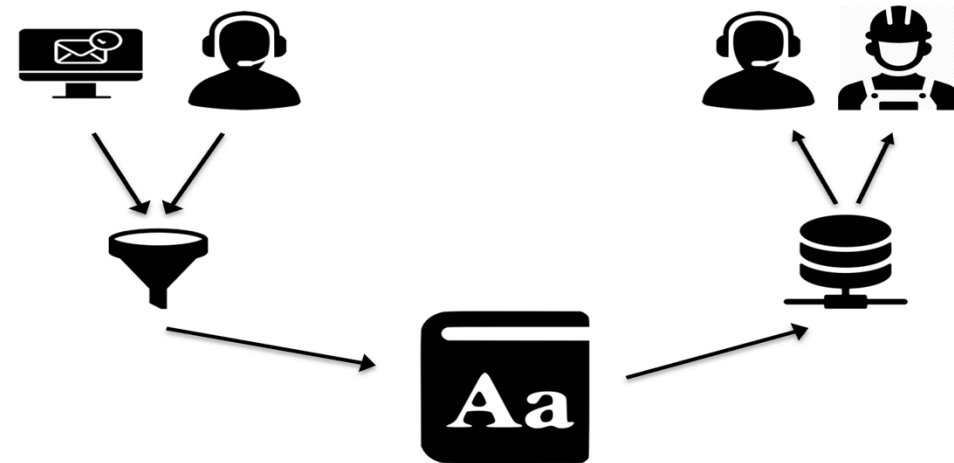
Ontology use in the UC9

🔵—Purpose of ontology application in the use case

• Terminology unification

• Data integration

• Knowledge sharing

🔵—Indication of the technical challenges

• **Multi-media/channel input** for the same case (phone calls, social messaging, tele diagnosis chats, emails, ticketing forms, formal service enquiries, service reports)

• **Heterogeneous** data (structural, functional, processual)

• Multiple **stakeholders** and data producers (engineers, technicians, users)

• Multiple **languages** (primarily Italian and English, occasionally others)

UC 9 requirements

Implementation of the ontology

- The ontology-based glossary needs to rely on an **ontological view of the domain**

- The glossary needs to be coherent with a variety of **stakeholders' perspectives**

- The glossary shall not be constrained to the maintenance viewpoint (**data reuse for other purposes**)

- The glossary shall allow to capture data on **unexpected machine scenarios**

Regarding tools (foreseen)

- Standard tools for OWL ontology writing, maintenance and update

- Parser of natural language text

- Software integration of the different IT components (database, glossary, user interfaces)

Main expected benefits

Comprehensive records of maintenance cases, frequency and solutions

Elicitation of **comparable cases/histories** of maintenance

Assessment of **new anomaly cases** and associated solutions

Allocation of maintenance skills and spare parts

Alignment of terminology across internal (and possibly external) personnel

Optimization of company/client maintenance service interaction

Thank you

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