

# TOWARD ONTOLOGY-BASED PRODUCTION - RELATIONS BUILDING AIRPLANES

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# Production then, now and in future



- Traditional production:
  - one plant
  - fixed job allocation
  - one product
  - huge lot size
  
- Future production
  - distributed plants
  - flexible job allocation
  - costum-tailored products
  - small lot sizes

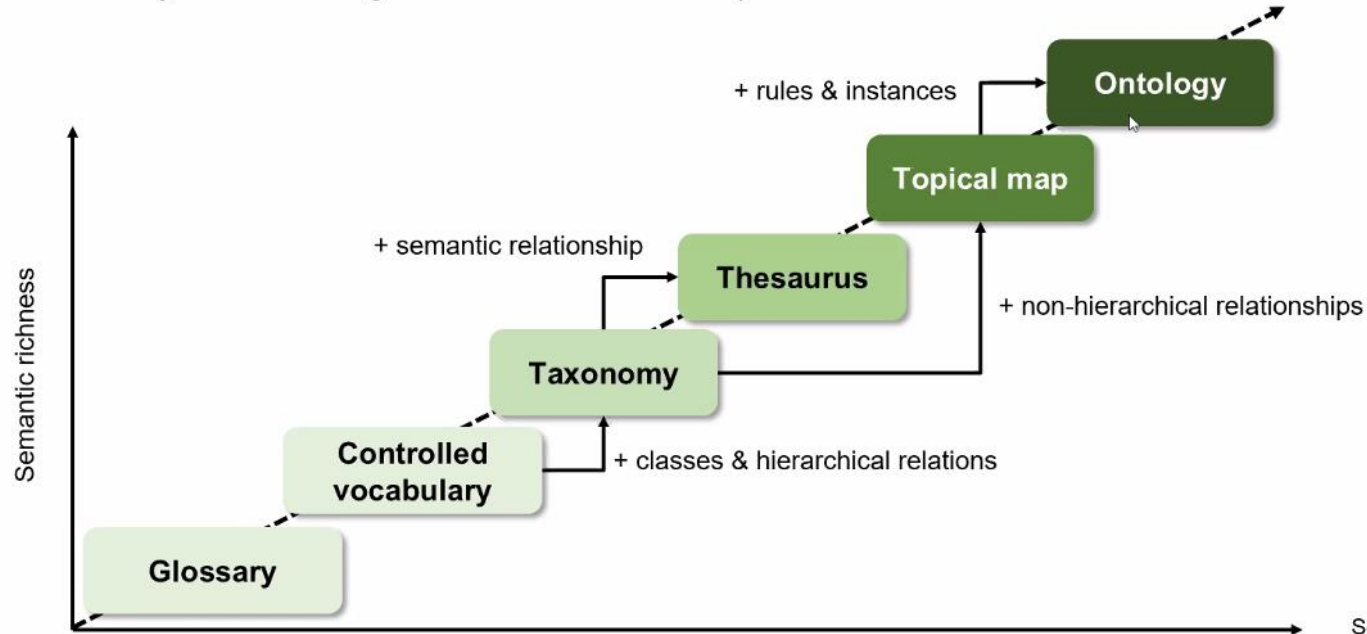
# Challenges



- flexible job scheduling
- automated job generation/scheduling
- distributed knowledge
- standardized/unified description of involved entities and their relations/capabilities/properties

## Formalization - Semantic staircase

Ontologies are a form of knowledge representation to provide formalized knowledge for machine services. They are knowledge models that describe parts of the world.



# Ontologies' Ingredients



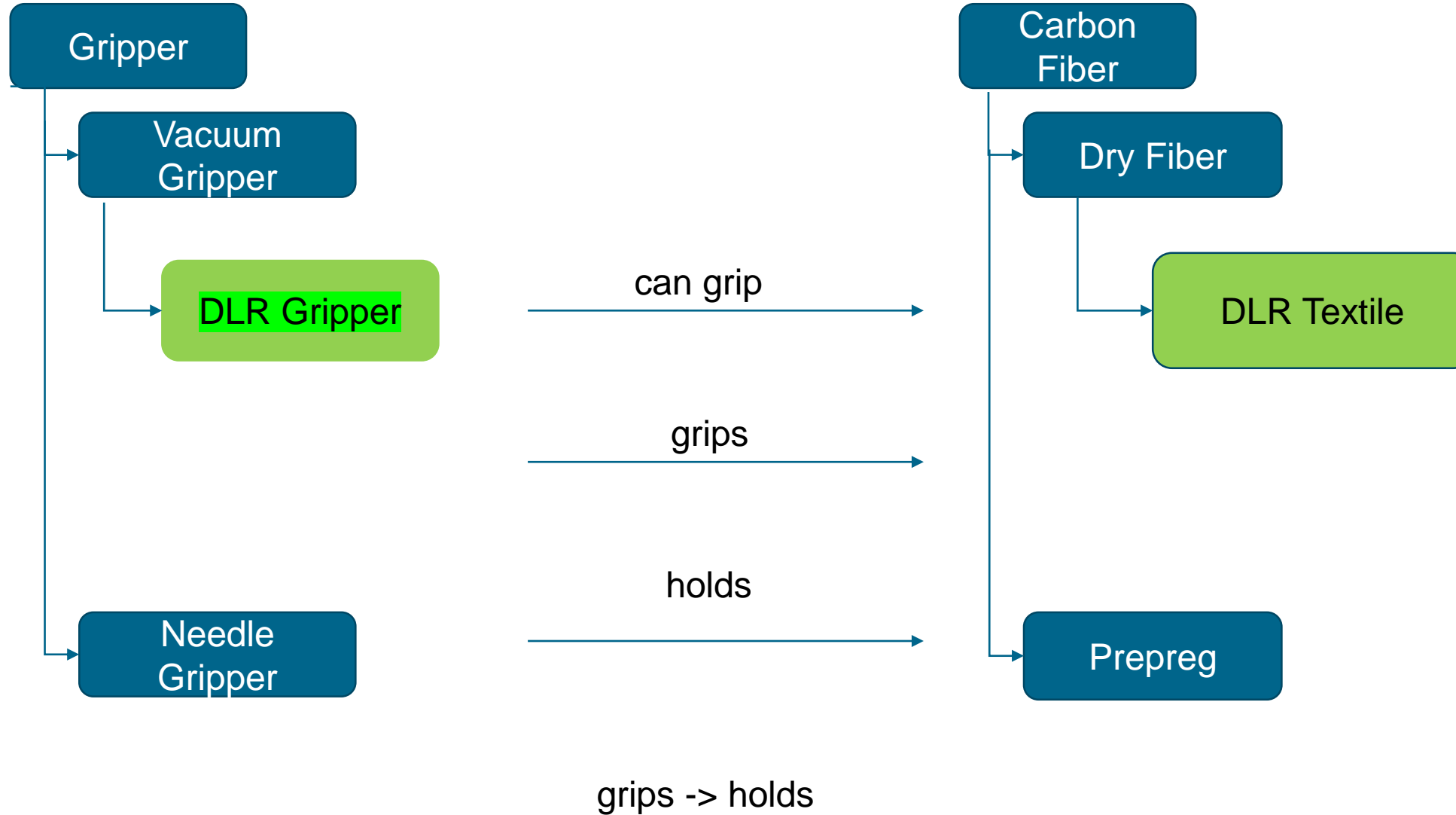
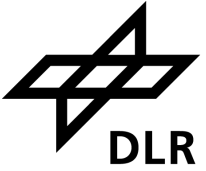
- classes
  - attributes
  - relations
  - restrictions
  - individuals
  - actions/events
  - rules
- Encoding in special formats (mostly XML-based, **R**esource **D**escription **F**ormat)
  - accessible via **I**nternationalized **R**esource **I**dentifier)
  - querying by SPARQL
  - [protégé](#) as editing tool

# Handling Ontologies



- Encoding in special formats (mostly XML-based, [Resource Description Format](#)), [OWL](#)
- Accessible via [IRI](#)
- Querying using [SPARQL](#)
- Entities involved in production process publish properties/capabilities via IRIs

# Gripper and Material Ontology



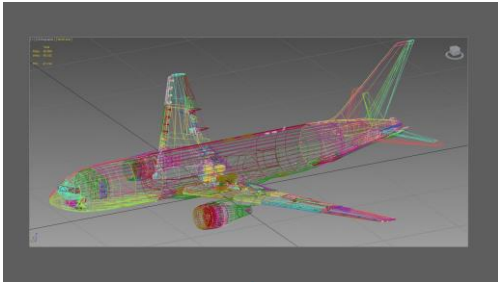
# Problem Domain Definition Language



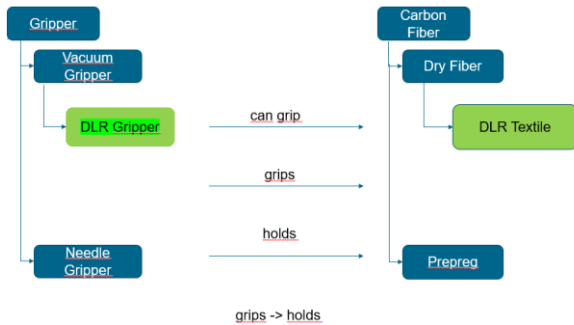
- [PDDL](#) enables defining process steps in precondition – action – postcondition style
- Domain file defines possible actions
- Problem file defines concrete problem
- Solver tries to find solution, possibly subject to some optimality criteria
- Preconditions, actions and postconditions taken from ontology based description
- Problem definition by decomposition of construction plan



# Workflow



```
(:action pick-ply3-rob2
:parameters (?p - ply3type ?r - rob2)
:precondition (and (not(busy2 ?r)) (at-ta
:effect (and (ply3-picked-rob2 ?p ?r) (bu
)
```



# Future Work



- Algebraic/relational description of ontologies
- Algebraic/relational semantics of SPARQL
- Algebraic/relational properties of PDDL