

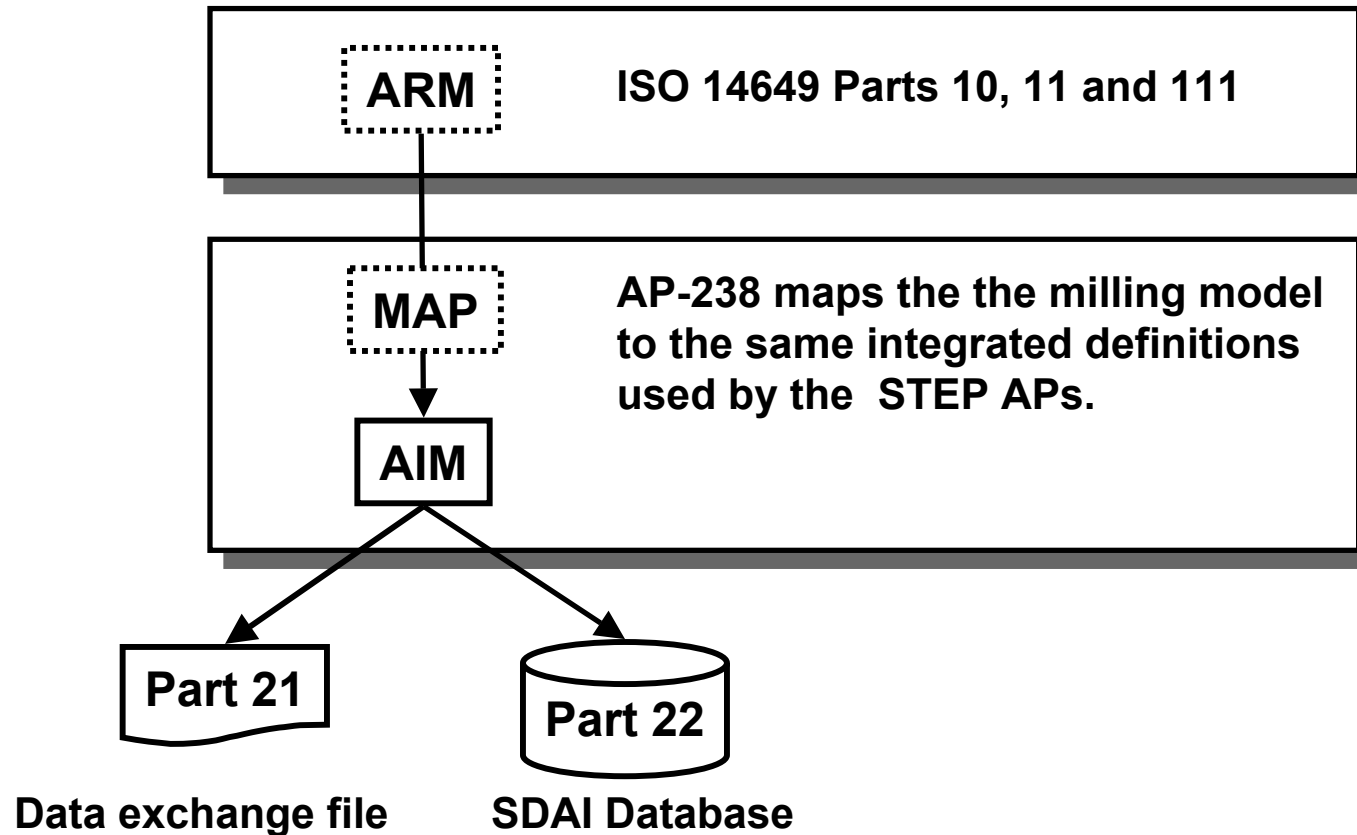
Introduction to STEP-NC

*AP-238 and the STEP
Integrated Resources*

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- **AP-238 describes how to implement STEP-NC so that it works with existing STEP APs.**
 - AP-238 maps the ISO 14649 information requirements to the integrated definitions used by all other AP.
 - So you can use existing CAD systems, viewers, etc.
- **Why?**
 - Lets domain experts describe requirements clearly (ARM)
 - While the database stays extensible and interoperable with the other application protocols (AIM)
 - Each AP can describe one or two aspects of a product.
 - All APs can be put together to describe everything about a product.



The integrated model means milling information will be consistent with other aspects of a product described by STEP (AP-203, AP-214, etc.)

- **We will cover each part of the STEP-NC model**
 - The information requirements (ARM)
 - The database representation (AIM)
- **The final external form is the AIM database representation.**
- **When creating or traversing data, you may:**
 - Use this the AIM database form directly, OR
 - Wrap it in a high-level XML or programming interface to manipulate ARM concepts, OR
 - A little of both.

- **One STEP-NC AIM will cover all technologies**
 - First edition covers milling and turning.
 - Second edition will extend with EDM and others.
 - Amendments can add others as needed.

Measures Executable
Project Operation
Workpiece Toolpath
Features

Based on Part 10

Milling Process Operations
Milling Cutting Tools

Based on Part 11
Based on Part 111

Turning Process Operations
Turning Cutting Tools

Based on Part 12
Based on Part 121

EDM Process Operations
Other Technology Parts as they reach DIS

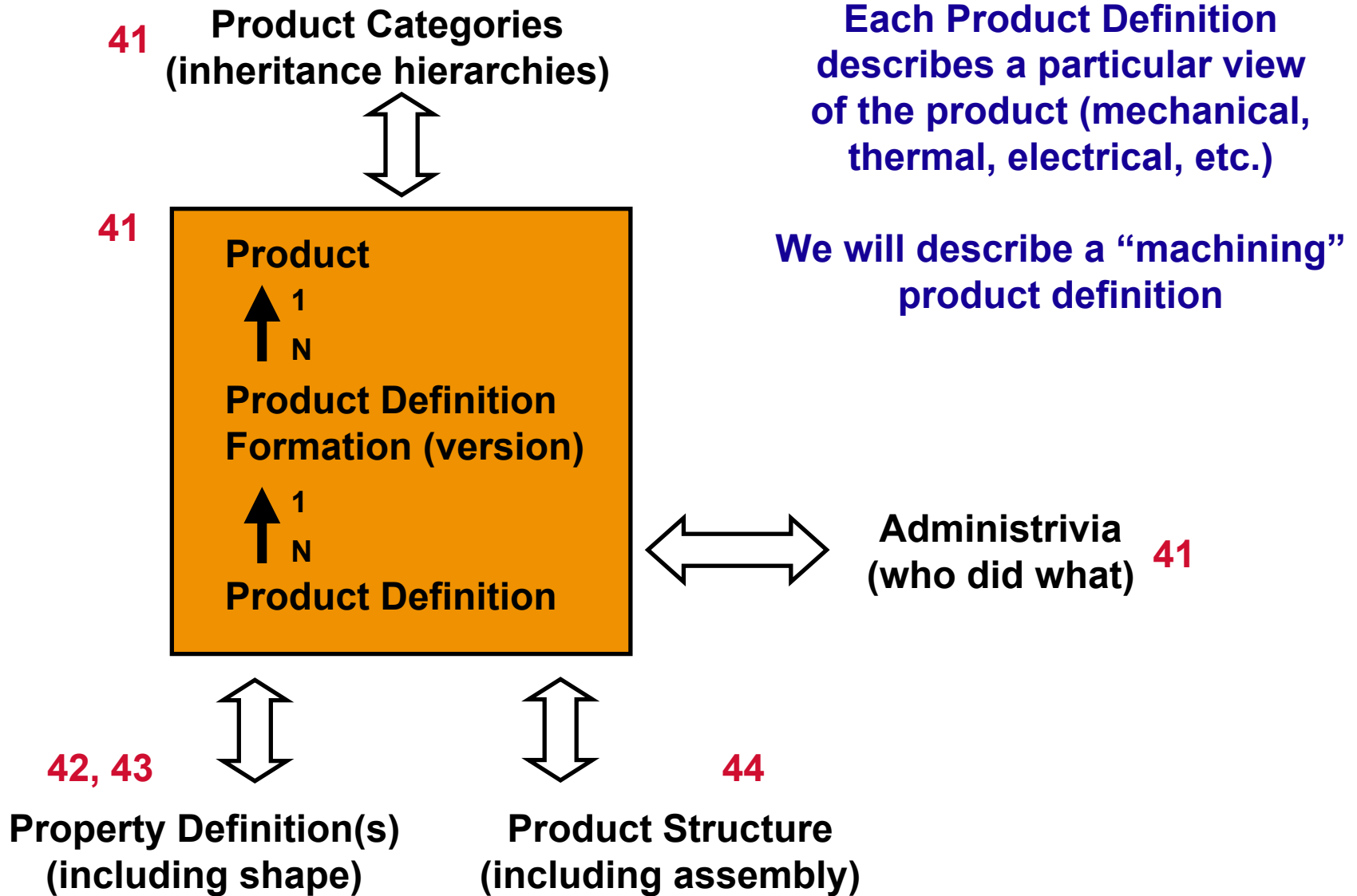
Based on Part 13

First
Edition

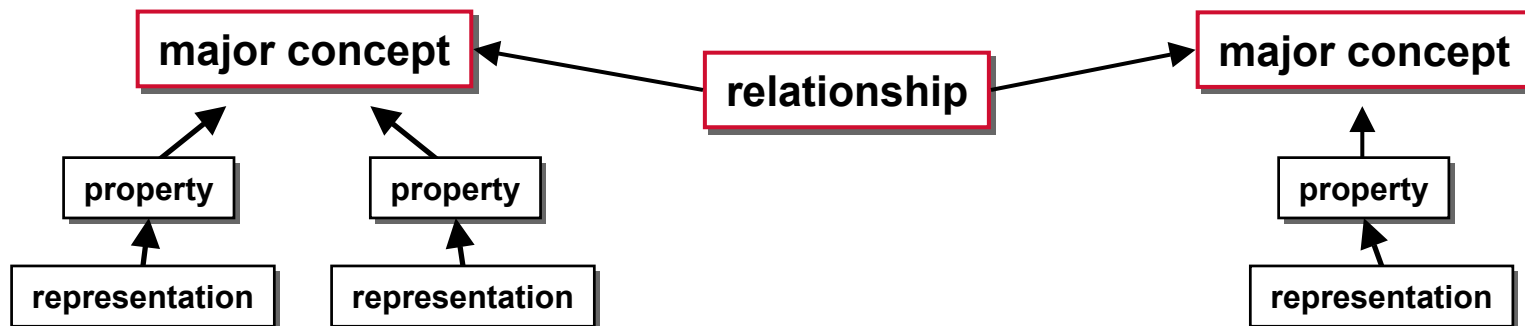
Second
Edition

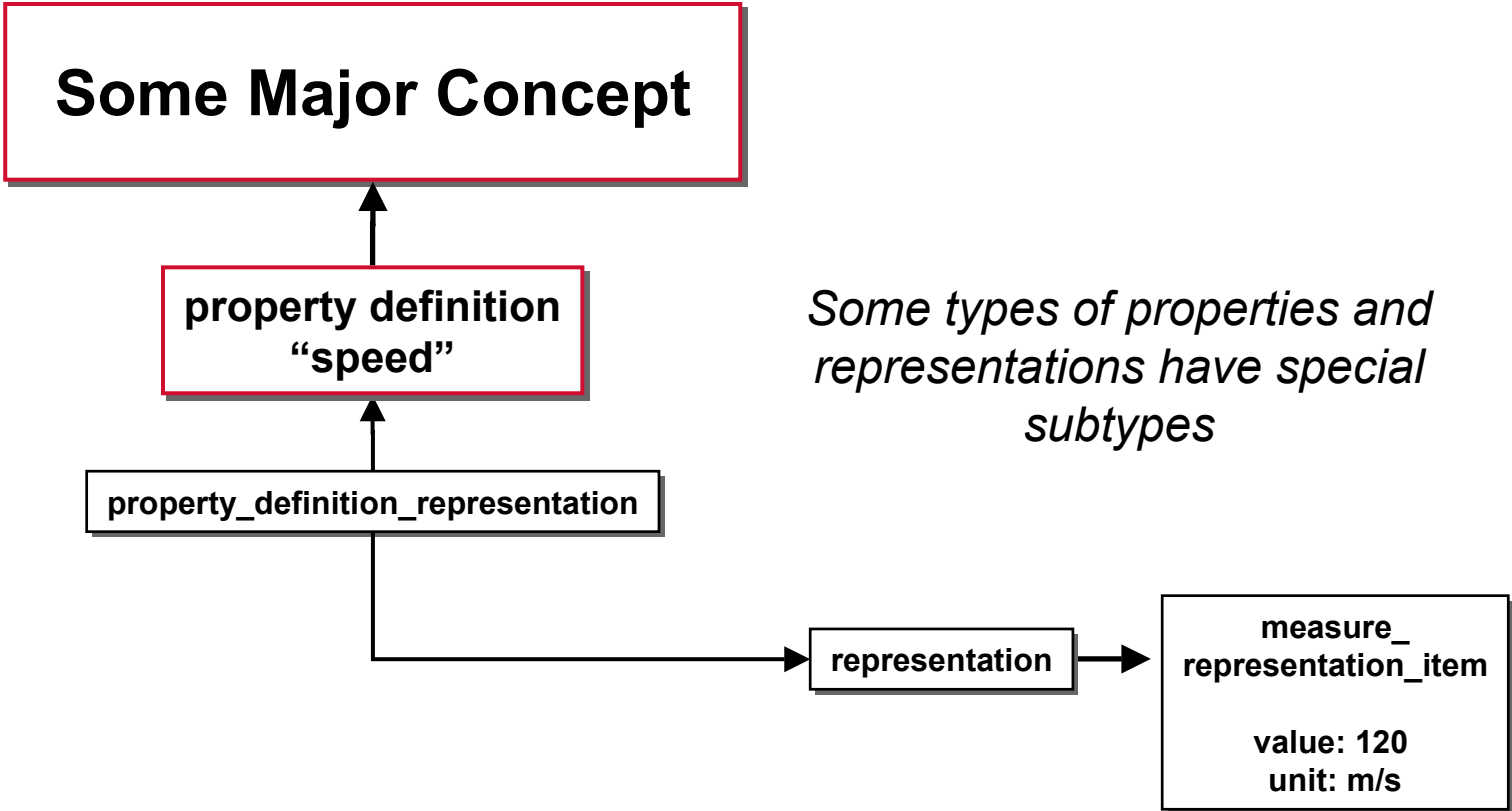
- **All APs contain tables describing how the integrated definitions are used to represent the information requirements**
 - Called mapping tables
- **For each object and attribute in the information requirements, the mapping table shows:**
 - What integrated resource object represents it, and which IR document defines it.
 - A reference path through the database to get to it, including required values in some of the objects (where name = xyz)
 - Any global EXPRESS rules that apply to it.

- **Information requirements are represented using the definitions in the Integrated Resources**
 - Part 41 - Product versions, dates, times, people
 - Part 42 - Representation geometric shapes
 - Part 43 - Representation of other properties
 - Part 44 - Relationships between products
 - Part 49 - Actions
- **IRs have very general definitions, so we might create some subtypes to make it clearer.**
 - STEP-NC is primarily about actions, so we will create subtypes of things from Part 49.
- **Write EXPRESS rules for any extra requirements on the information.**



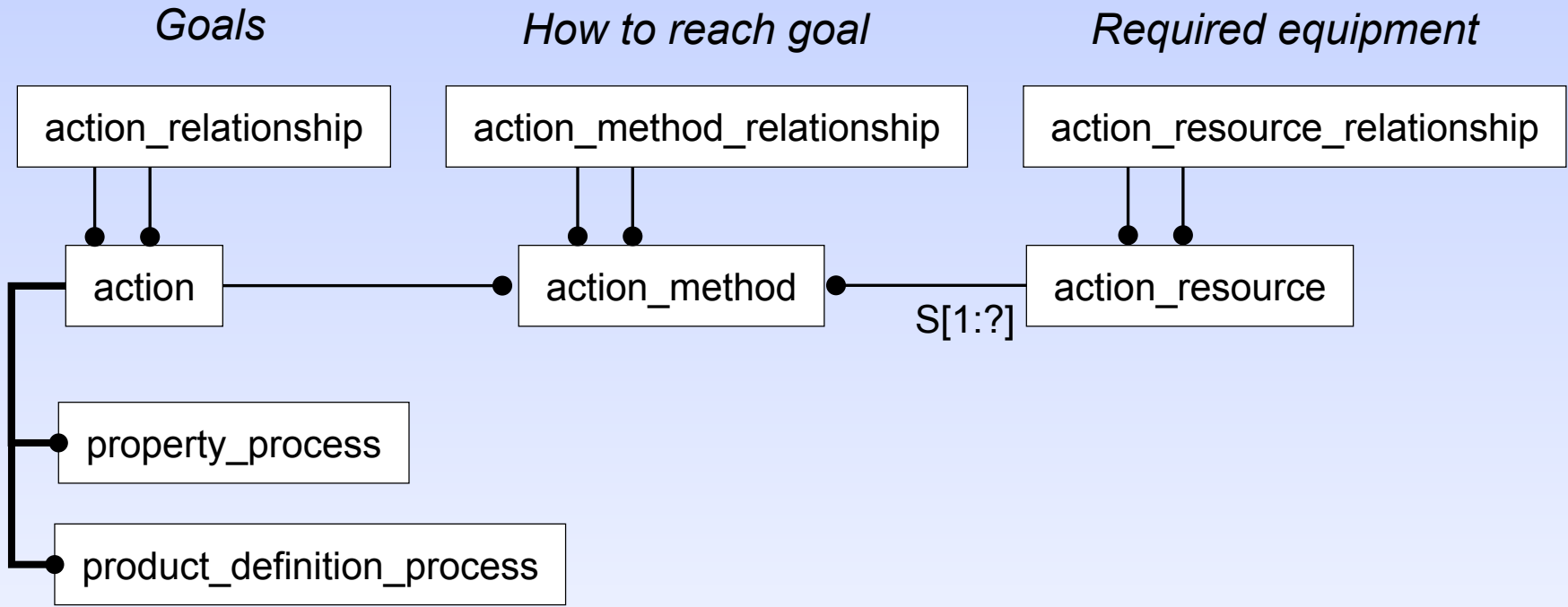
- **Major Concepts**
 - Represented as product, action_method, action_resource.
- **Relationship between major concepts**
 - Represented as relationship object (product definition relationship, action method relationship)
- **Properties**
 - Represented as property object with associated representation.
 - Representations can be simple (scalar value) or complex (multiple scalar values, geometry, expressions)



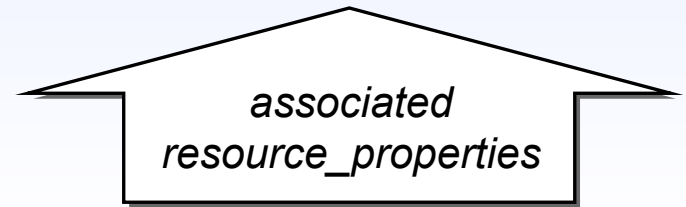
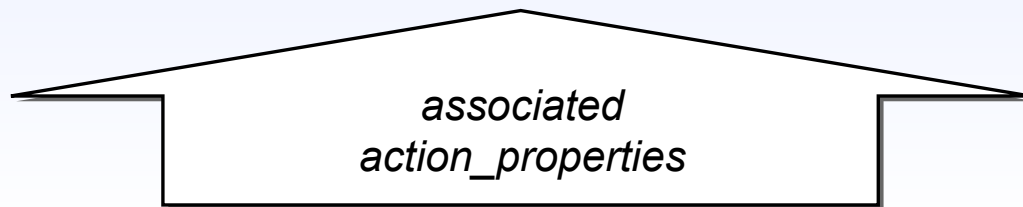


Why so much indirection?
So a property can have multiple representations,
and a representation (like shape) can be reused

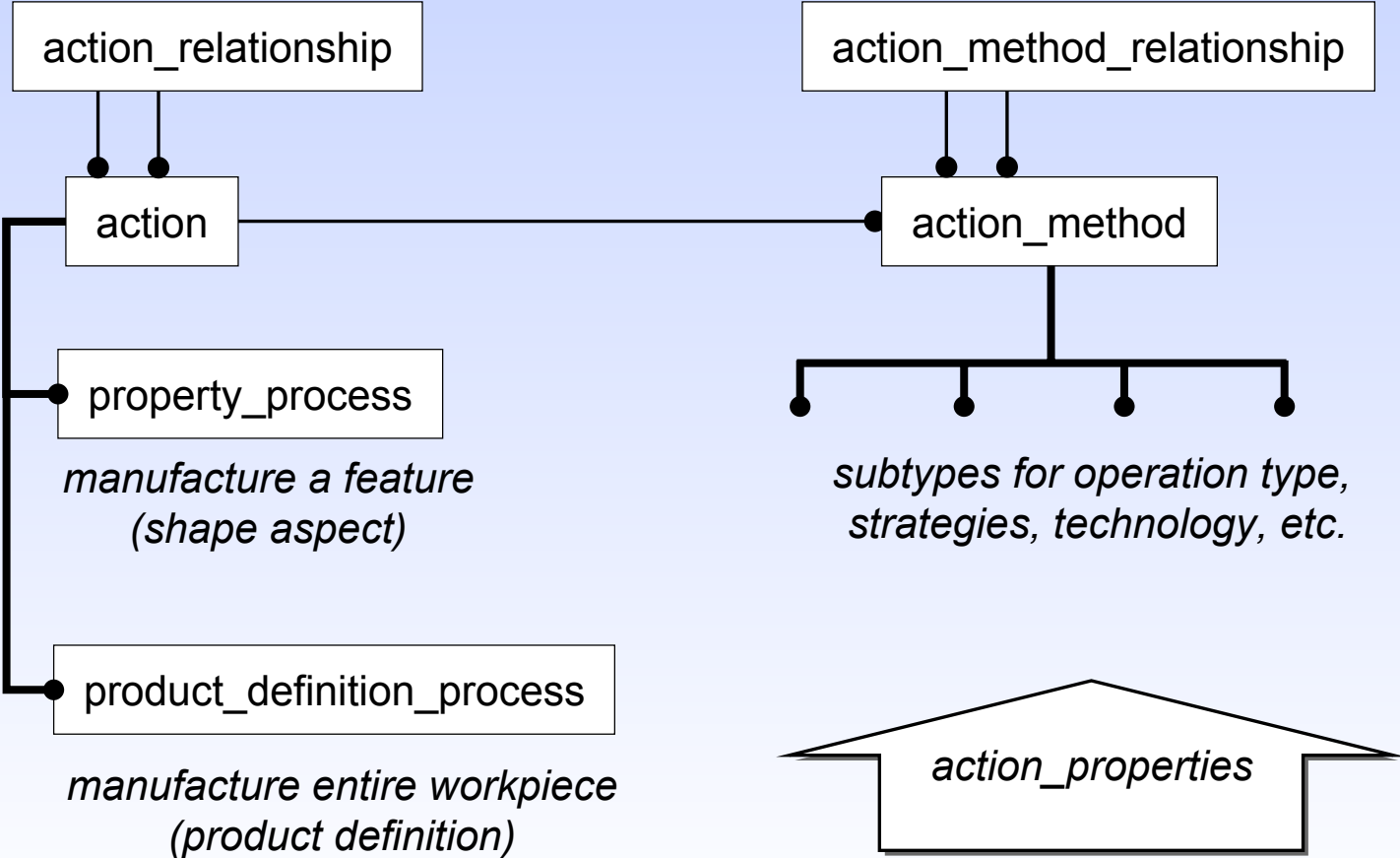
- **Action and process information are described in Parts 41 and 49**
- **In Part 41**
 - Action_schema
- **In Part 49**
 - Method_definition_schema
 - Process_property_schema
 - Process_property_representation_schema

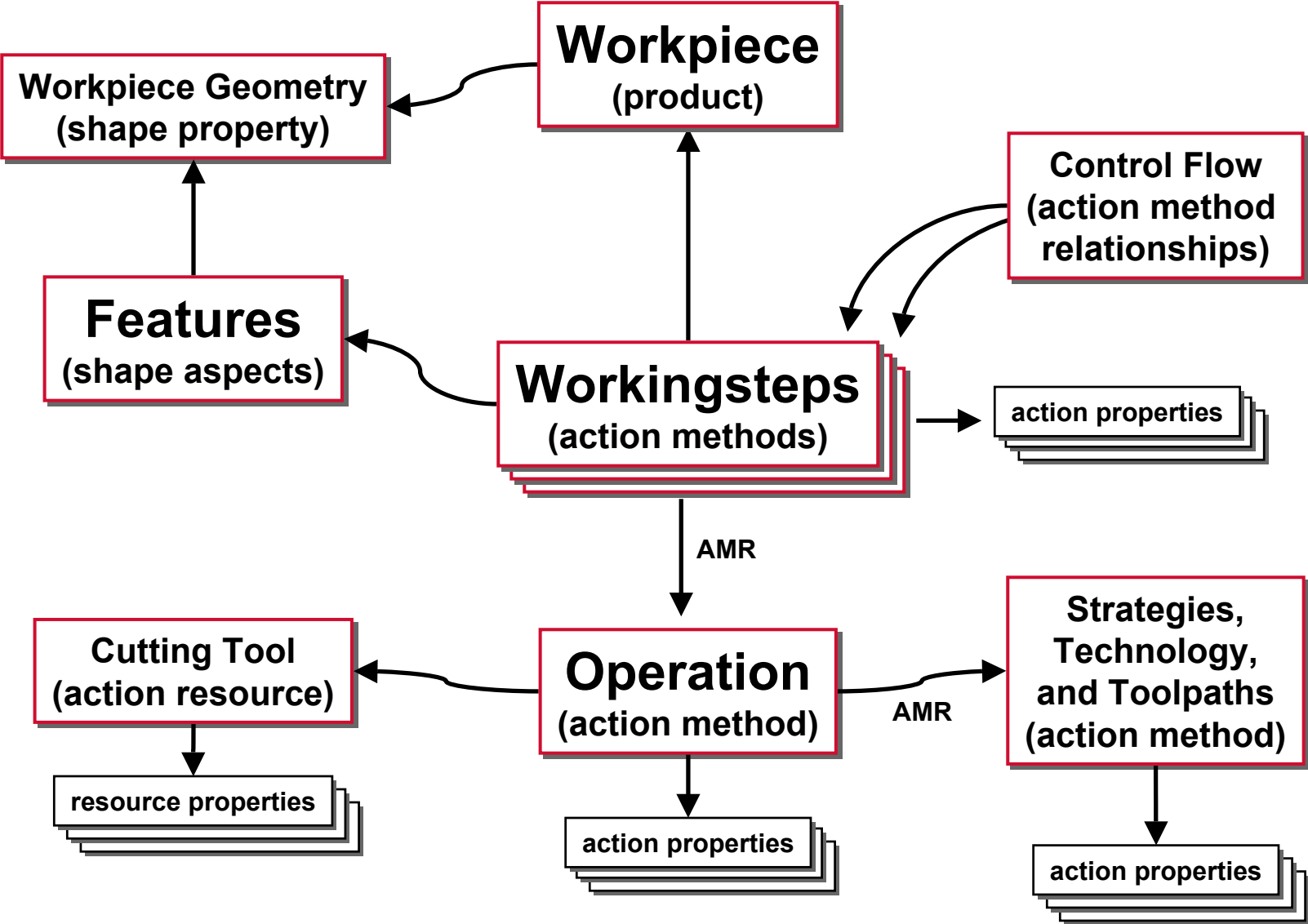


relate to products, shape aspects



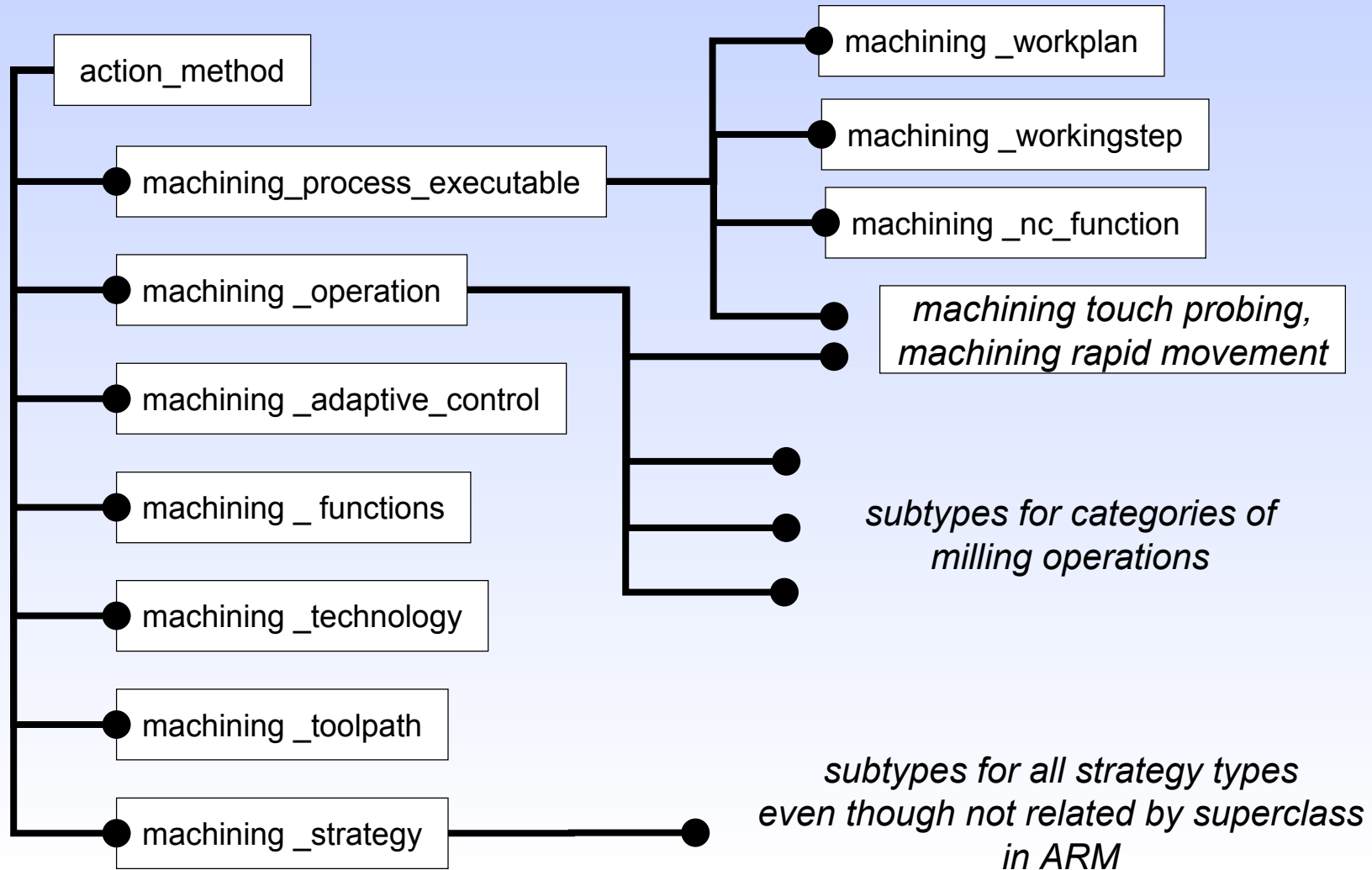
- **Goals are to manufacture features and the workpiece**
 - action (property_process) related to feature.
 - action (product_definition_process) related to workpiece product definition.
- **Reach goal through workplan and its working steps, plus operation, strategy, toolpath and machine functions.**
 - action_methods describes each of these.
 - action_method_relationships describe roles that they play.
- **Tool is equipment required by the operation**
 - action_resource related to the operation action method.





- **In the AIM, many things may be mapped to the same IR definition.**
 - For example, strategy, workingstep, operation are all action methods.
 - ARM concepts often distinguished by special strings in name or description fields.

- **Use subtypes of the integrated resources to simplify constraints and make the model clearer**
 - Just for identification, never adds new attributes.
 - Can write local (where) rules rather than global rules.
 - Use prefix “machining” where possible to avoid name conflict with other concepts in other APs.
 - Use the same name where concept is the same in other APs, such as the manufacturing features.
 - Subtype relationships to clarify the links between objects.



- **Mapping of STEP-NC process data harmonized with process data from other APs.**
- **AP-214**
 - Describes process goals and dependencies, mapped as actions
- **Old AP-213, New AP-240**
 - Describes process plans within a shop, mapped as action methods.
- **AP-238**
 - Describes workplans on one machine, mapped as action methods.