



# Introduction to **STEP-NC**

*The STEP-NC Backbone:  
Executables*

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- **Machining Workingsteps**
  - Describe a sequence of material removals, location, and associated parameters
- **Questions**
  - How are workingsteps organized into a workplan?
  - How are workingsteps related to an operation?
  
  - How are workingsteps related to a feature?
  - How are workplans related to a project?

- **The heart of the STEP-NC model**
  - Workplans containing a sequence of workingsteps.
  - Each workingstep associates an operation with a feature somewhere on the workpiece.
  - Each operation describes what to do and what strategies and parameter settings to use.
- **More information than M and G codes. Linked with geometric and technological information.**
- **Parameters can be grouped and shared, e. g. tools, feeds, etc.**
- **Intelligent NC controllers can calculate tool movements for standard features.**

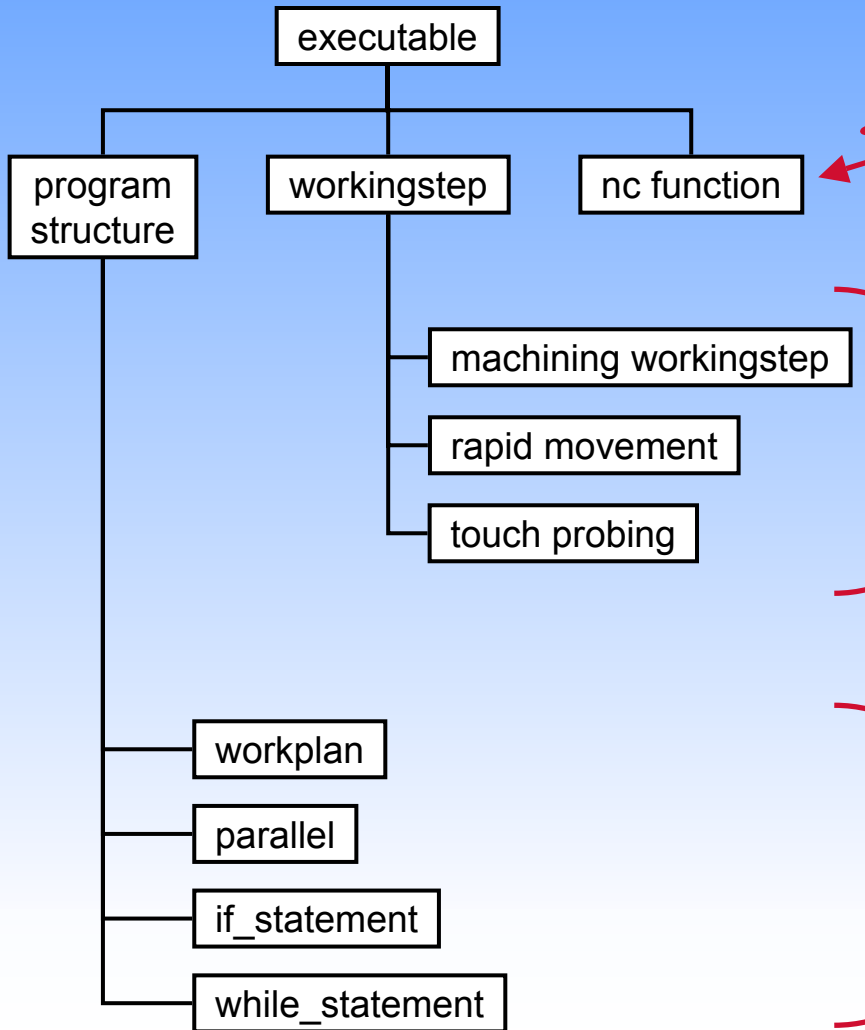
- **Executables**

- Describes control flow and sequencing.
- Workingstep associates an operation and a feature.
- Technology independent

- **Operations**

- Describes what to do within the feature context given by a workingstep — plane mill, center drill, etc.
- The basis for all technology-specific extensions.
- Specifies details like
  - » spindle, feedrate and other technology parameters
  - » coolant & other machine functions
  - » plunge strategies, tool paths, etc.

## STEP-NC Executables

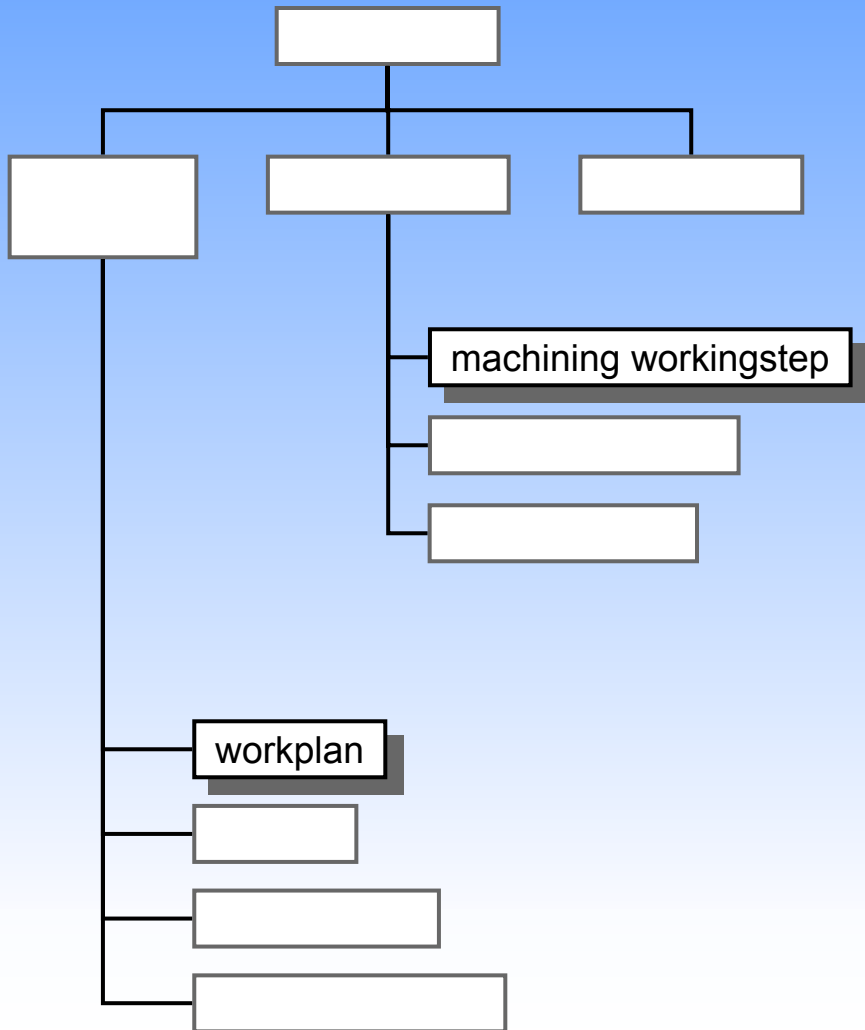


Program steps that do not move any machine axes (display message, etc.)

Program steps that move the machine axes

Control flow for the machining program

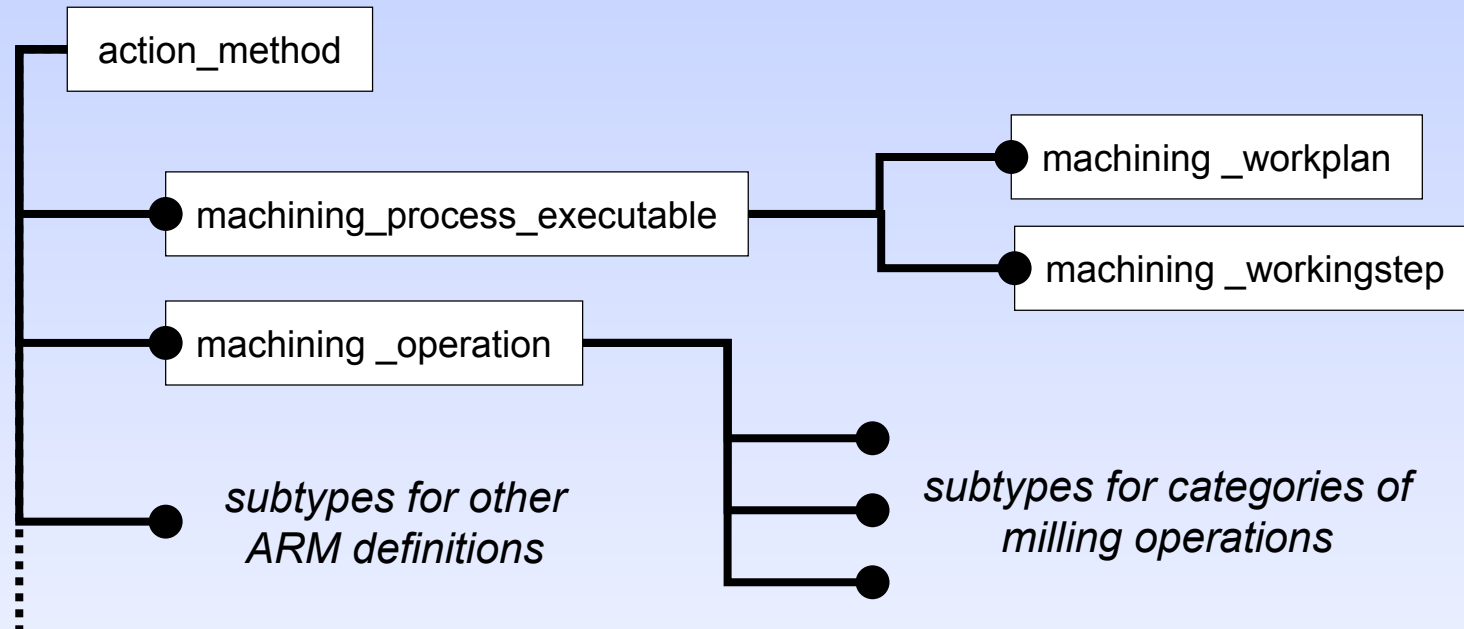
## STEP-NC Executables



**Focus on a simple machining program**

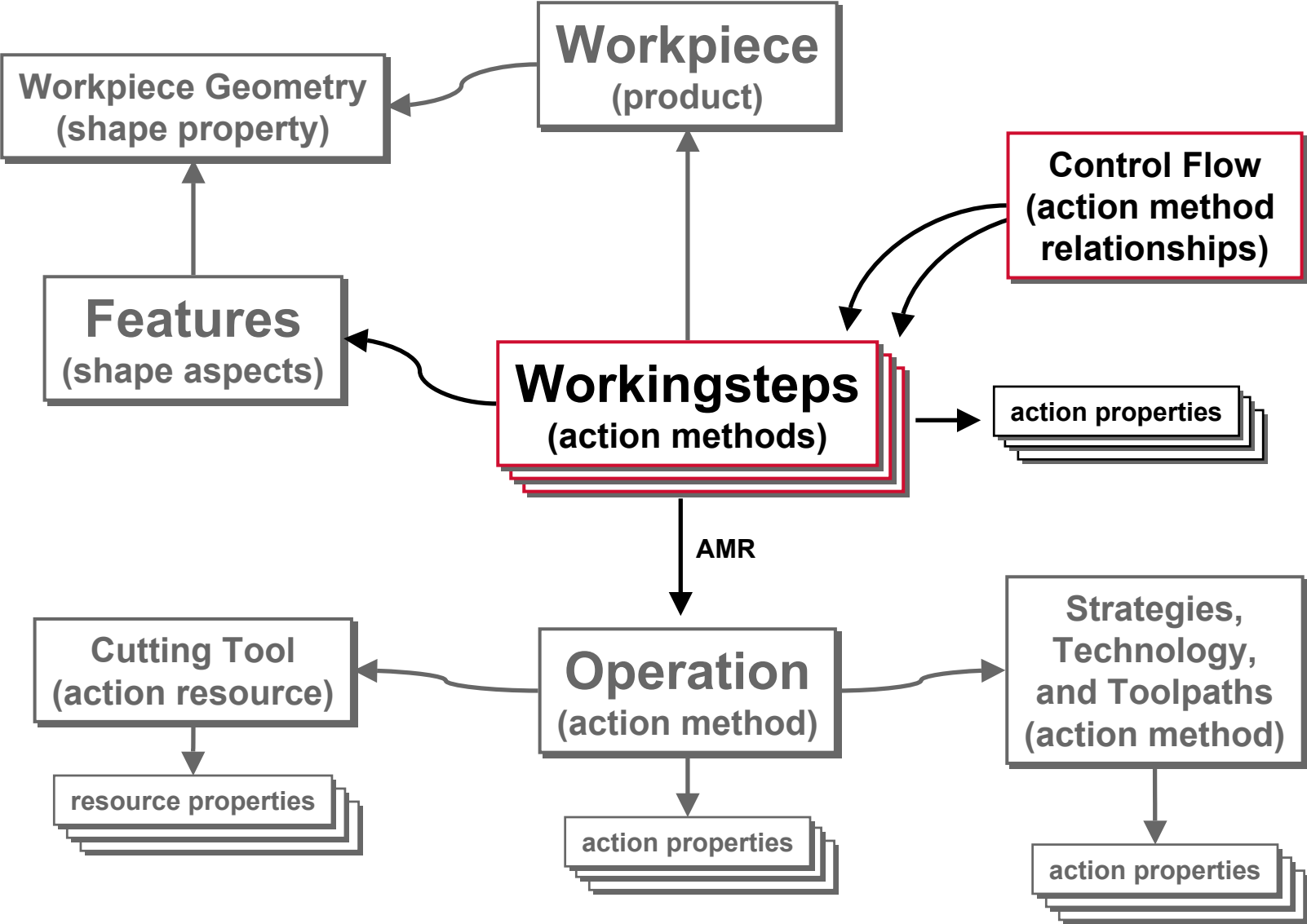
**A Workplan containing a sequence of Workingsteps**

- **A Workplan**
  - Has a list of workingsteps to be executed
- **A Workingstep**
  - Refers to an operation that describes what to do.
  - Refers to a feature that describes a location and material removal volume.
  - Has a security plane for moving to/from other steps.
- **All executables (workplans and workingsteps)**
  - Have an id so you can refer to them.

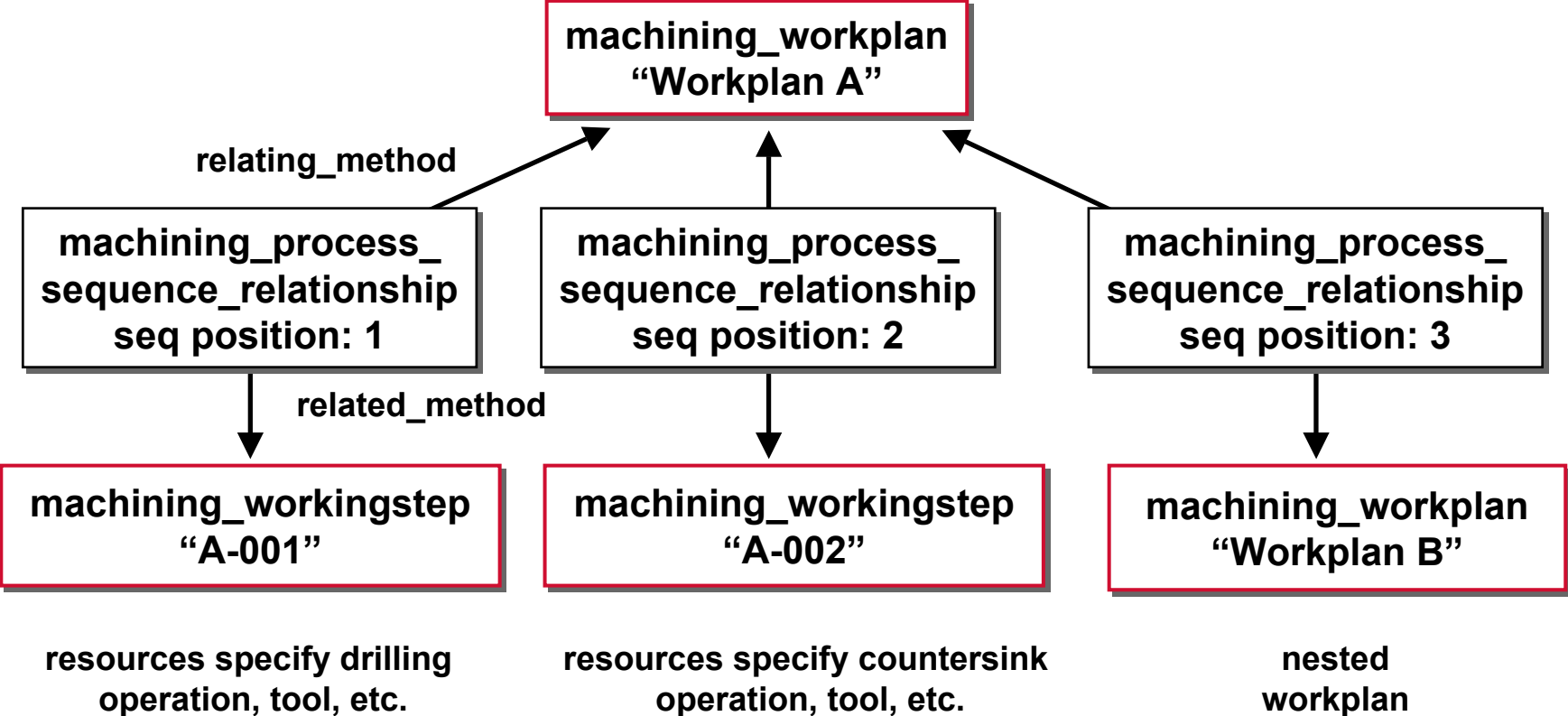


- **Executables and operations are represented using action methods**
  - Special subtypes for operations, workplan, and workingstep
  - Related to each other by `action_method_relationship` subtypes

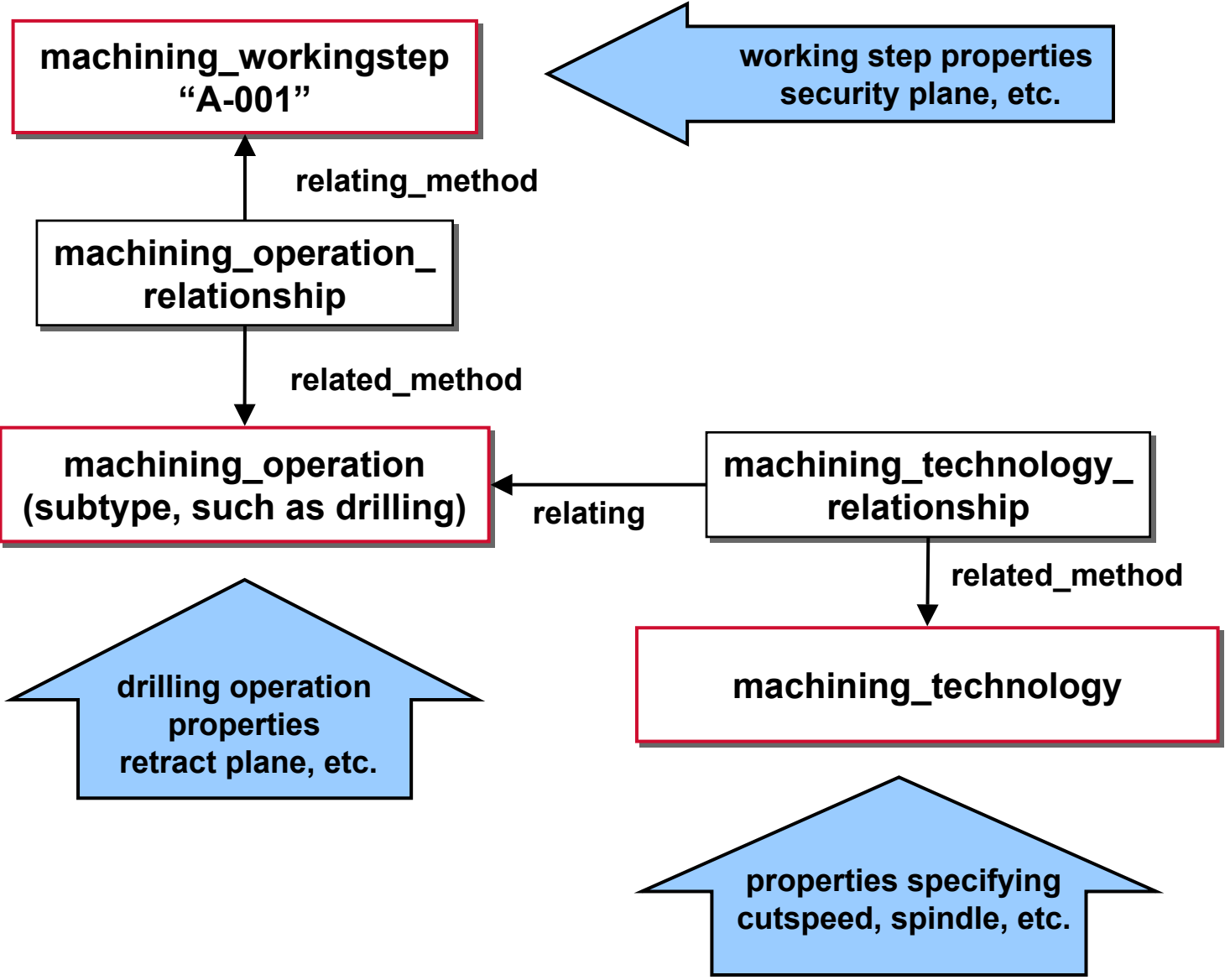




- **Look at how to represent some tangible examples.**
  - **How are workingsteps organized into a workplan?**
  - **How are workingsteps related to an operation?**
  
  - **How are workingsteps related to a feature?**
  - **How are workplans related to a project?**

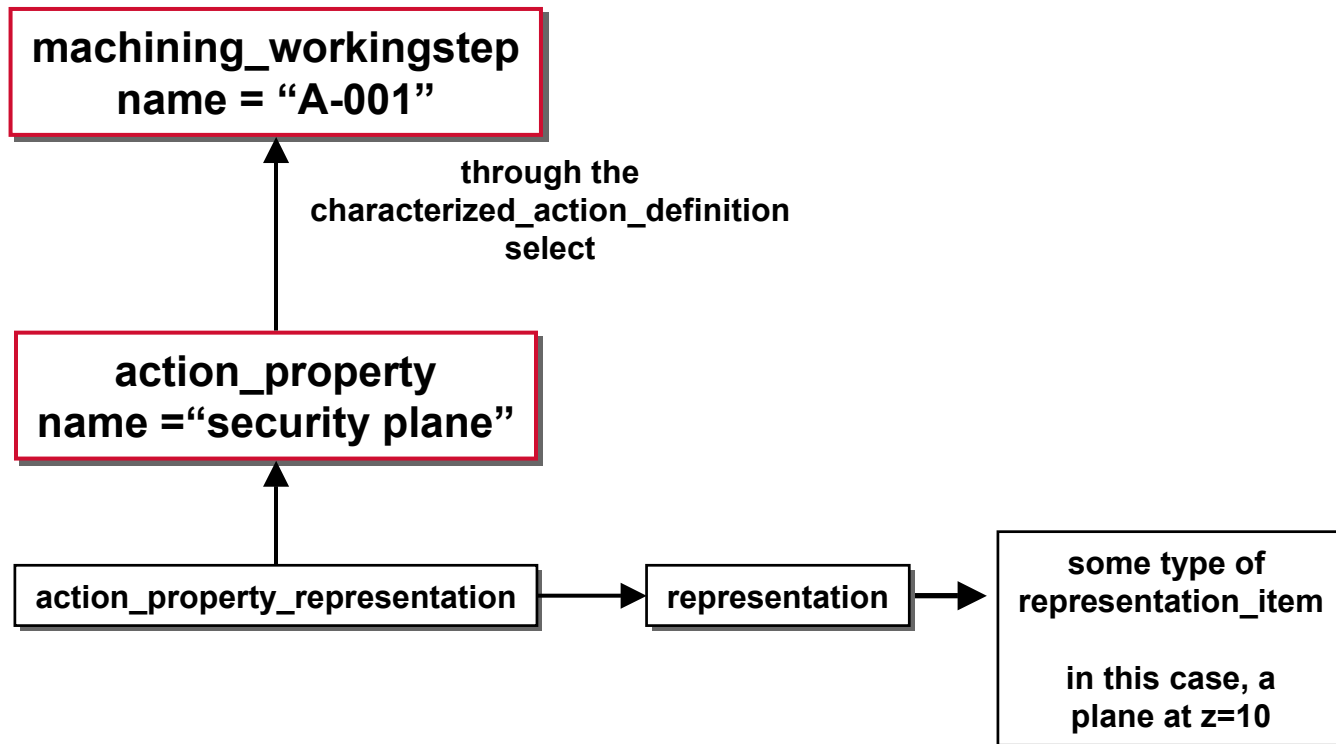


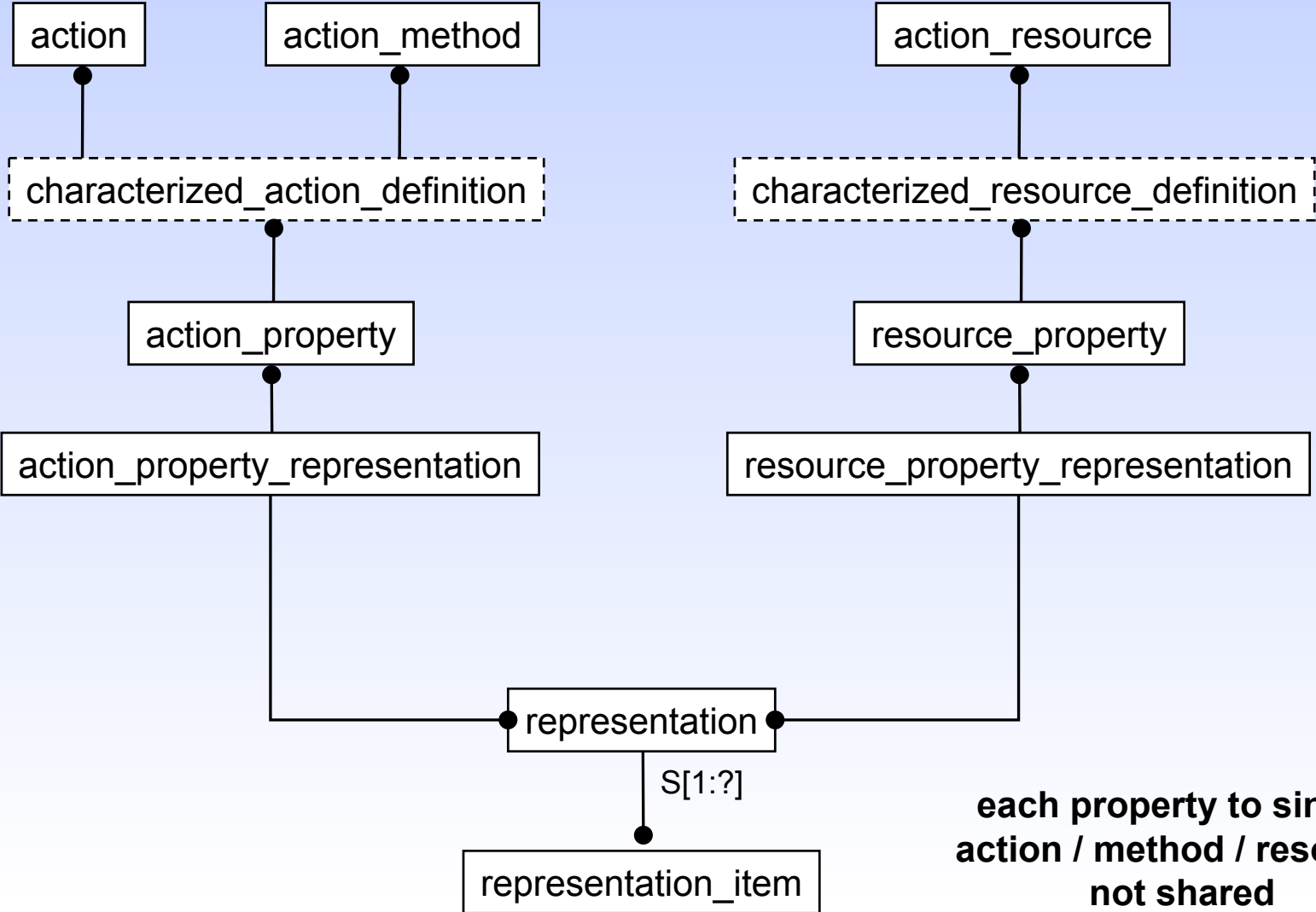
**machining\_process\_sequence\_relationship**  
has a sequence number used to establish ordering  
(subtype of action method relationship & sequential\_method)



Similar for machining strategy and machine functions

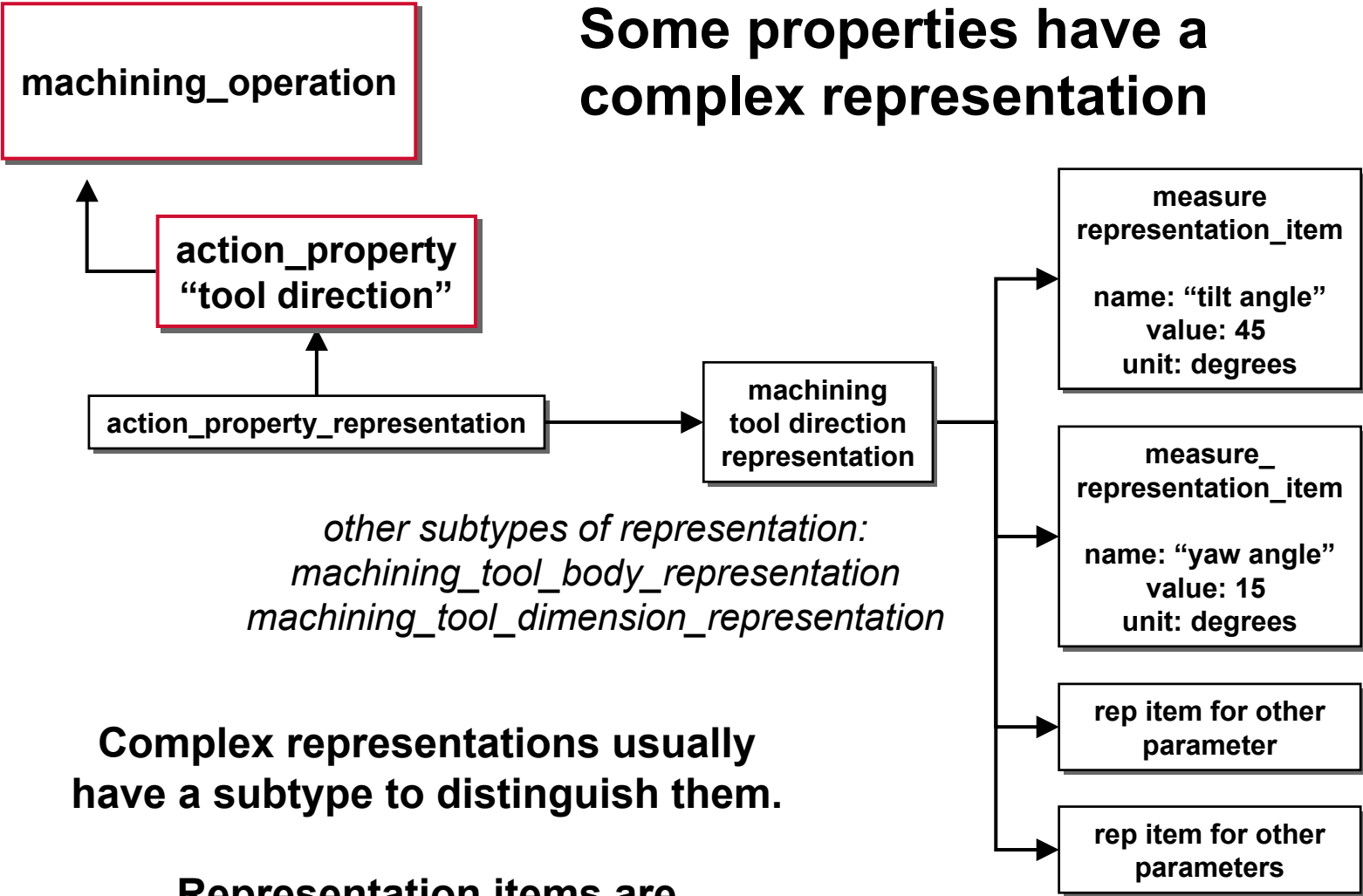
- The required properties for a particular concept are called out by the ARM
  - Workingstep has a security plane





**each property to single  
action / method / resource  
not shared**

## Some properties have a complex representation



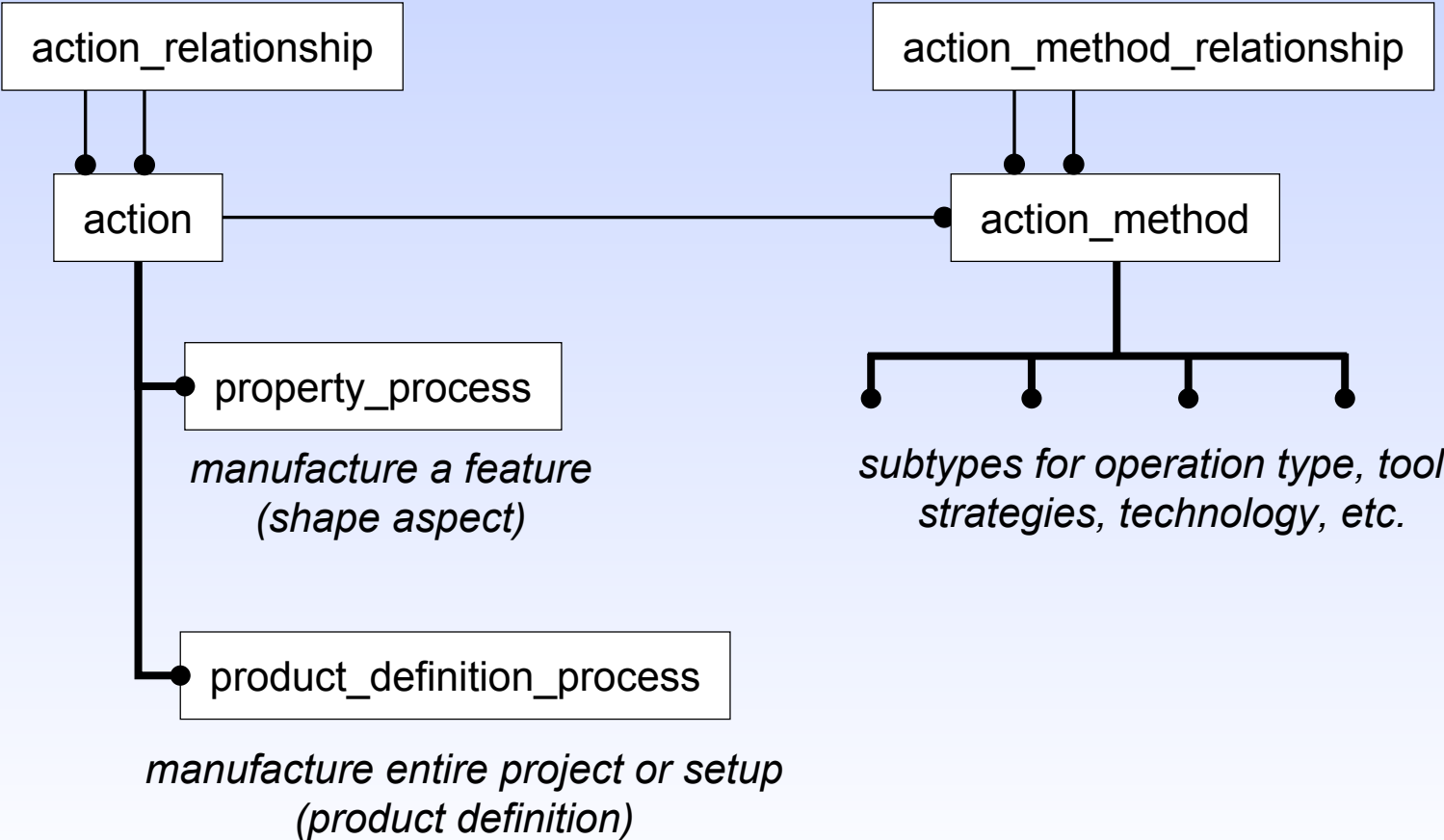
*other subtypes of representation:  
machining\_tool\_body\_representation  
machining\_tool\_dimension\_representation*

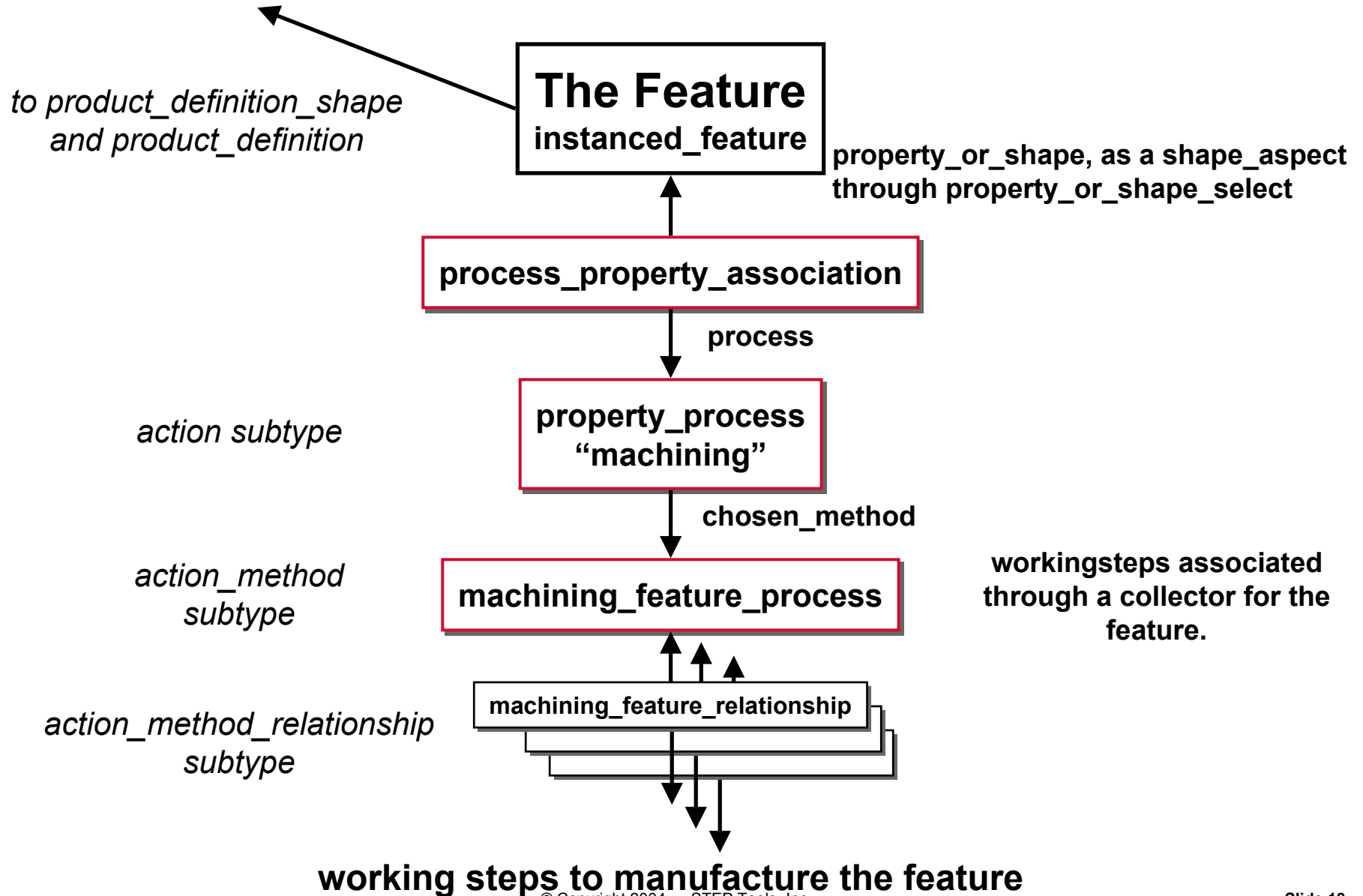
**Complex representations usually have a subtype to distinguish them.**

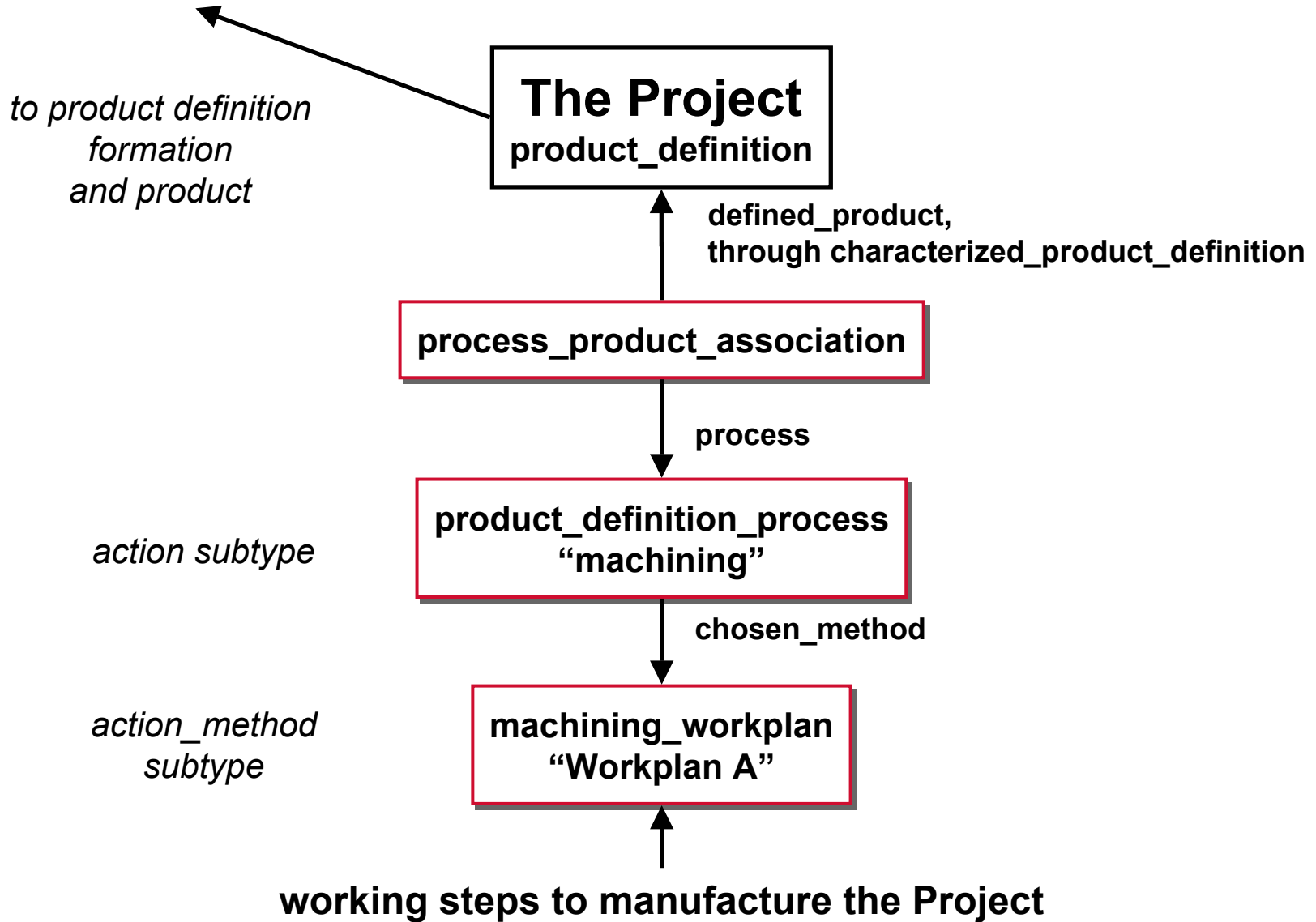
**Representation items are distinguished by name**

- **STEP process schemas use goals and the methods used to attain them**
  - Workplans, workingsteps are methods.
  - What are the goals?
  
- **Goals are to manufacture features and the project**
  - action (property\_process) related to feature.
  - action (product\_definition\_process) related to project product definition.









- **Machining Workingsteps**
  - Describe a sequence of material removals, location, and associated parameters
- **Workingsteps are organized into a workplan**
  - Using sequence position in a type of action method relationship, to describe the ordering
- **Have related properties**
  - Which are described by a representation
- **Are related to an operation**
  - Using an action method relationship subtype
- **Are related to features and project**
  - Using action, of which the workplan is the chosen method