Modeling Assembly and Component

This chapter focuses on modeling complex objects that are assemblies and the roles their parts play within them.

# Pattern: Components of an Assembly and their Roles

Objective:  
To model not just the physical composition of an assembly, but also the *function* or *role* that each part plays. This pattern distinguishes between an object as a physical thing and its role as a "product" or a "component."

Scenario:  
Consider a bicycle. As a whole, it is a "product" that you can buy. The wheel is a physical part of that bicycle, and in that context, it plays the "component" role. The wheel itself might be an assembly (with a tire, rim, spokes), where the tire is a component. This pattern allows us to model these nested, role-based relationships.

Description:  
This pattern builds on the concept of physical parthood and introduces roles from IOF.

1. **Physical Objects (bfo:MaterialArtifact):** All parts are physical things. In the diagram, ns1:assembly1, ns1:assembly2, ns1:component1, and ns1:component2 are all instances of bfo:MaterialArtifact. ns1:assembly1 is the top-level product.
2. **Physical Composition:** The hasComponentPartAtAllTimes property links assemblies to their components physically.
   * ns1:assembly1 has ns1:assembly2 and ns1:component2 as its parts.
   * ns1:assembly2 has ns1:component1 as its part.
3. **Roles (iof:Role):** Objects play different roles depending on the context.
   * iof:MaterialProductRole: This role is for a final, sellable product. The main assembly (ns1:assembly1) plays this role.
   * iof:MaterialComponentRole: This role is for any part that is used to build a larger assembly. All the sub-parts (ns1:assembly2, ns1:component1, ns1:component2) play this role.
4. **Assigning Roles:** The hasRole property connects a physical object (bfo:MaterialArtifact) to the role it plays.

This structure allows us to query for "all components of product X" (by looking at roles) or "all physical parts of assembly Y" (by looking at the part-whole relationship), which are two different but related questions.

A diagram of a company

AI-generated content may be incorrect.

Diagram: A Multi-Level Assembly