Product Architecture

Modular Architecture

- chunks implement one or a few elements
- interactions between chunks are well-defined and fundamental to the primary functions of the product
- allows a design change in one chunk without requiring changes to other chunks
- most modular: each functional element is implemented by exactly one chunk

Integral Architecture

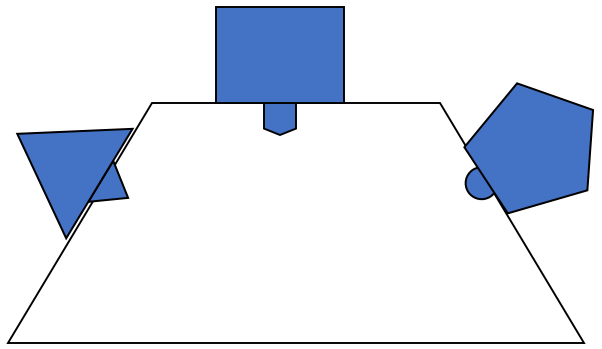
- functional elements of the product are implemented using more than one chunk
- a single chunk implements many elements
- interactions between chunks ill-defined, may be incidental to the primary functions of the products
- used with products with highest possible performance in mind

Types of Modularity

- Slot-modular architecture
- Bus-modular architecture
- Sectional-modular architecture

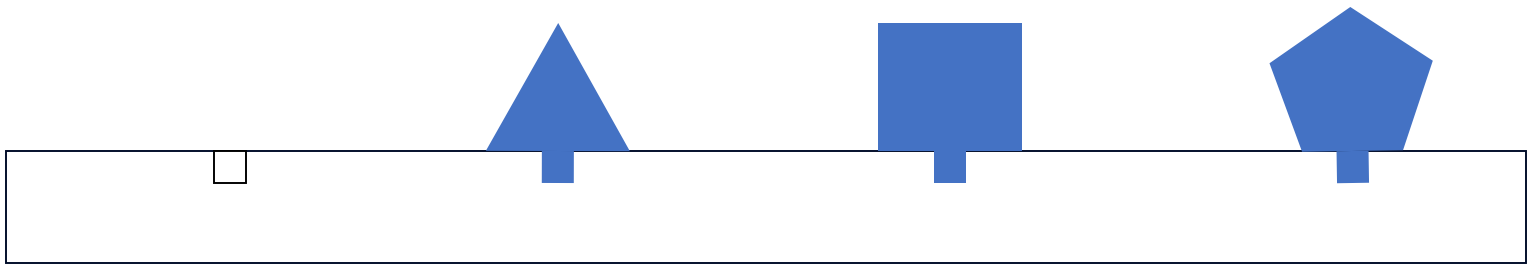
Slot-Modular Architecture

- **each interface between chunks different - various chunks cannot be interchanged**
- **example: automobile radio - implements exactly one function, but interface different from any other components in the vehicle**



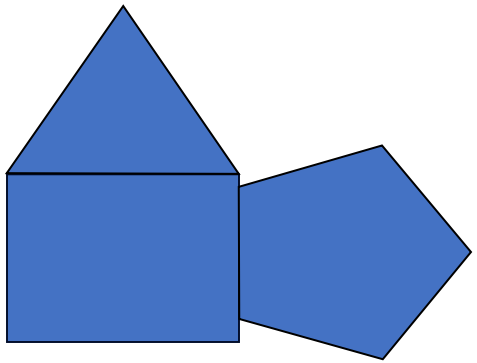
Bus-Modular Architecture

- a common bus to which chunks connect via the same type of interface
- examples: track-lighting, shelving system with rails, expansion card for PC

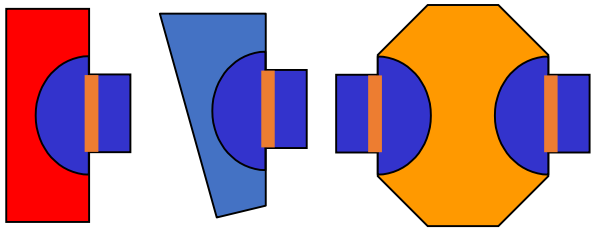


Sectional-Modular Architecture

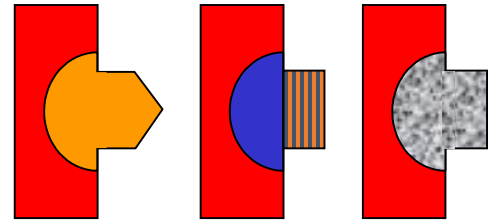
- all interfaces of same type, but no single element to which all other chunks attach
- assembly built by connecting chunks to each other via identical interfaces
- examples: piping systems, office partitions



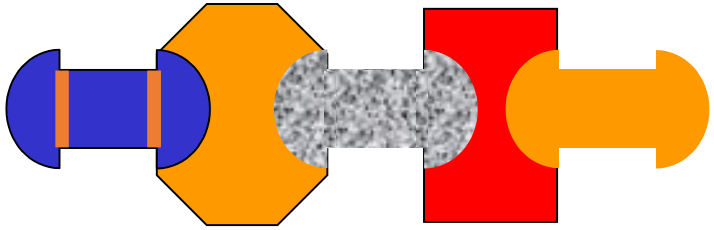
Types of Modularity



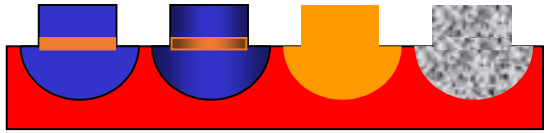
Swapping Modularity



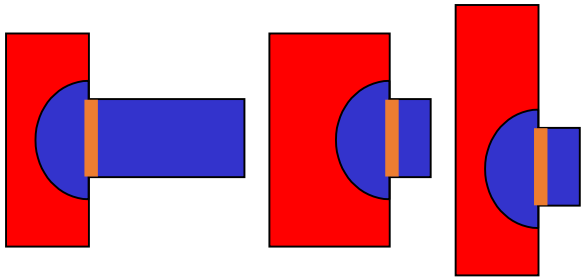
Sharing Modularity



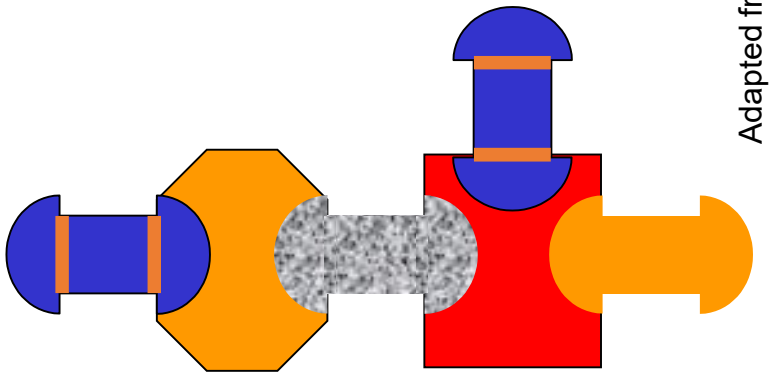
Sectional Modularity



Bus Modularity



Fabricate-to-Fit Modularity



Mix Modularity

Adapted from K. Ulrich," The Role of Product Architecture in the Manufacturing Firm", *Research Policy*, 1995.

Fundamental Decisions

- Integral vs. modular architecture?
- What type of modularity?
- How to assign functions to chunks?
- How to assign chunks to teams?
- Which chunks to outsource?

Integral Product Architectures

- Functional elements are implemented by multiple chunks, or a chunk may implement many functions.
- Interactions between chunks are poorly defined.
- Integral architecture generally increases performance and reduces costs for any specific product model.

Modular Product Architectures

- Chunks implement one or a few functions entirely.
- Interactions between chunks are well defined.
- Modular architecture has advantages in simplicity and reusability for a product family or platform.

Swiss Army Knife

Sony Walkman

Integral Product Architectures

- Functional elements are implemented by multiple chunks, or a chunk may implement many functions.
- Interactions between chunks are poorly defined.
- Integral architecture generally increases performance and reduces costs for any specific product model.

Compact Camera