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# Systems Design

System design is based on identifying *functional* groupings that are arranged hierarchically in increasing complexity, and that interact to produce functions as defined by a [product requirements specification](#).

[Requirements](#) describe the role a product fills in a [situation](#) - that is, the [purpose](#) and [functions](#) of a product. The system design (also called the [architecture](#)) is the means to determine what other functions *internal* to the product are needed to provide the functions of the product as a whole, and to ensure that the interfaces between those functional elements (other systems) are accurately described.

Thus, system architectures represent the specification of the design of a product's function, which is a necessary step before designers can start looking for physical concepts to realize the functions in a product.

System architectures are also tools to manage the complexity of design situations.

**Example:** Consider automobiles. From an environmental point of view, the total pollution generated by one automobile includes much more than just the car's exhaust. It includes the pollution generated throughout every stage of its [life cycle](#) including, among other things:

- the waste generated in cafeterias servicing workers in factories;
- the gasoline burned in the cars of service people going to work who will maintain the car;
- toner used in printers owned by the manufacturer and every company member of the [supply chain](#) for the car;
- the sewage produced by the workers who build the robots used to assemble the car;
- the electricity needed to heat, cool, and illuminate storage areas where construction materials are kept to build the road on which the car will drive; and
- many, many, many more.

Thinking about all these sources, it should be clear that even for a relatively simple object like an automobile, the total number of systems that interact with the automobile over its life is very large, and the nature of those interactions can be very complex.

Using systems to model such situations can very significantly help manage their complexity.

The design and specification of system architectures from the point of view of this course, is defined by the steps listed in the [design roadmap](#). Obviously, one must understand about [systems](#) and [system diagrams](#).

A system architecture is specified by certain information which, when gathered and presented appropriately, forms a [product architecture specification](#).

[systems](#)

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