Chapter 2

Anatomy of a VHDL Model

2.1 Describing Electronic Hardware in VHDL

In order to simulate electronic hardware designs, the following information is required:

- Structural description of the design (netlist or schematic)
- Behavioral model for each device in the design (VHDL source or model library)
- Stimulus for the design (test vectors)
- Design configuration information (specify which version of each device model to use during simulation)

Each of these pieces of information will be highlighted in the following example.

Figure 2.1 shows the schematic diagram for an electronic circuit. Three nand gates perform the and-or operation for four inputs as shown. This schematic describes the structure by specifying the building blocks the design utilizes, and the interconnection between these building blocks and the outside world. The most common way of representing design structure is through the use of schematic diagrams, and typically these diagrams would be entered into a simulation environment via a schematic editor. An alternative is to express this information in the VHDL language using the structural description facilities available in VHDL as shown below.
The external ports of this circuit are defined in the entity declaration and indicate four input ports called a, b, c and d and one output port called g. The architecture section describes the VHDL structural information where three gates g1, g2 and g3 are declared, and the interconnection between the ports on these gates and the external ports of the simple circuit and the internal signals e and f is specified. This VHDL code corresponds exactly to the schematic representation given in figure 2.1. Often this type of input is referred to as a netlist. Most of the examples in this book assume that the structure for circuits will be entered via a schematic editor and in most cases the schematic diagram will be shown in an associated figure.

The structure shown in figure 2.1 is not sufficient to begin simulation. Equally important, each building block in the design must have a behavior associated with it. A behavioral description can be thought of as information that tells the simulator how a given building block in a design should react to all possible inputs that it sees. Each black box in a design can be thought of as a transfer function, with inputs and state determining the