

Datapath
vs.
Controller

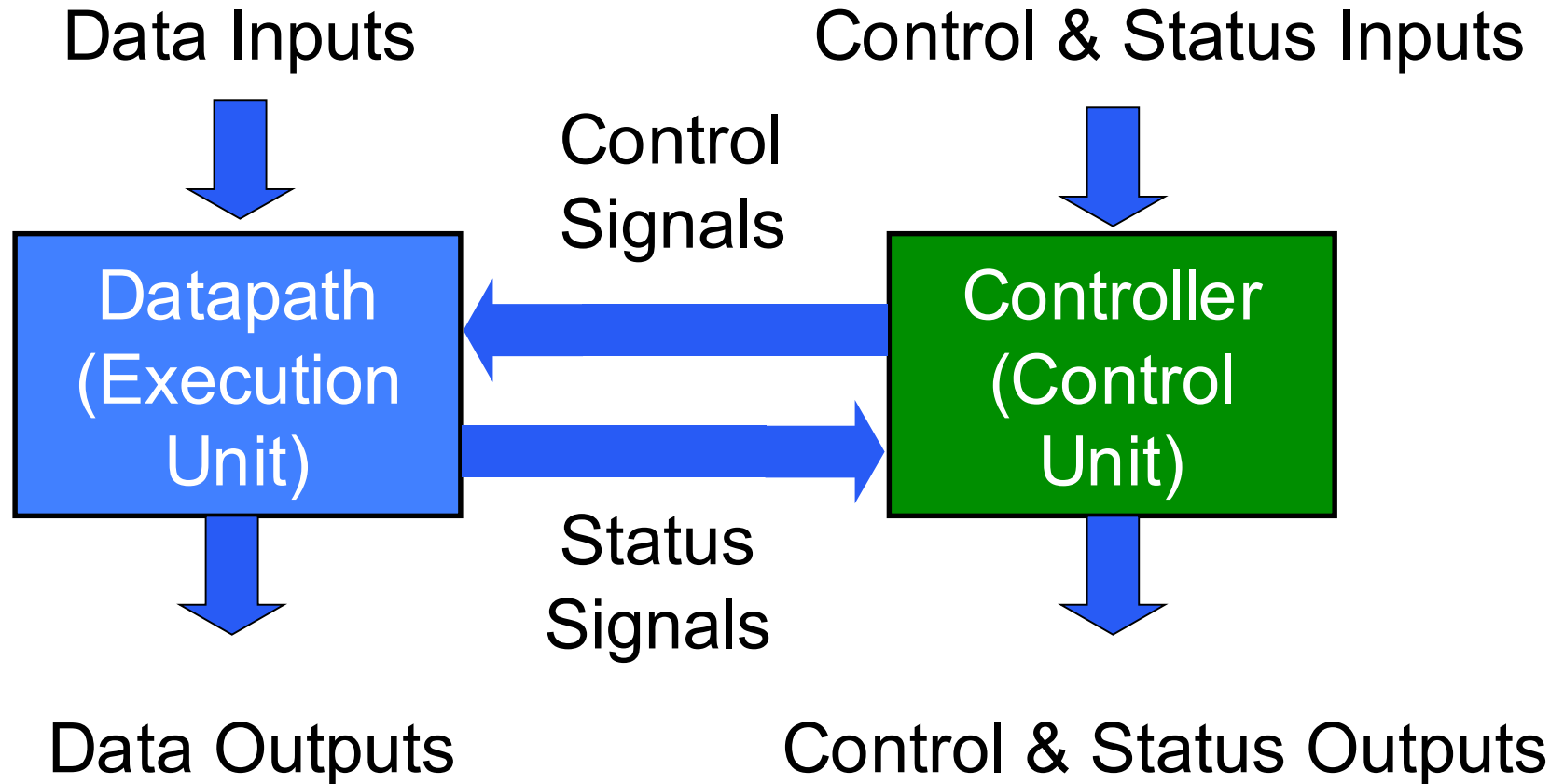
High Performance

CoolClock

Low Power

CoolGate

Structure of a Typical Digital System



Datapath (Execution Unit)

- Manipulates and processes data
- Performs arithmetic and logic operations, shifting/rotating, and other data-processing tasks
- Is composed of registers, multiplexers, adders, decoders, comparators, ALUs, gates, etc.
- Provides all necessary resources and interconnects among them to perform specified task
- Interprets control signals from the Controller and generates status signals for the Controller

Controller (Control Unit)

- Controls data movements in the Datapath by switching multiplexers and enabling or disabling resources

Example: enable signals for registers

Example: control signals for muxes

- Provides signals to activate various processing tasks in the Datapath
- Determines the sequence of operations performed by the Datapath
- Follows Some 'Program' or Schedule

Programmable vs. Non-Programmable Controller

- Controller can be programmable or non-programmable
- Programmable
 - Has a program counter which points to next instruction
 - Instructions are held in a RAM or ROM
 - Microprocessor is an example of programmable controller
- Non-Programmable
 - Once designed, implements the same functionality
 - Another term is a “hardwired state machine,” or “hardwired FSM,” or “hardwired instructions”
 - **In this course we will be focusing on non-programmable controllers.**