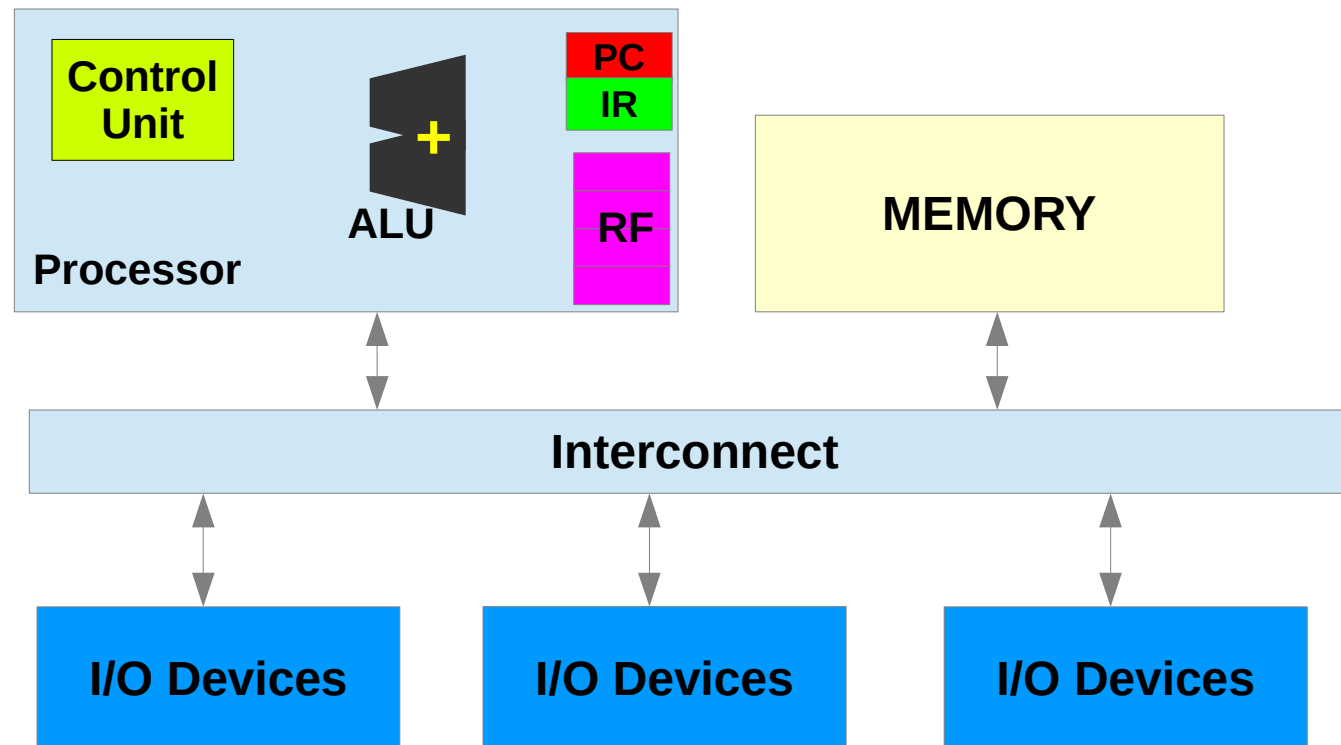# Frequency,
Processor Performance Equation

Module Outline

- Concept of frequency.

- Processor performance equation.

-

Basic Computer Organization

- Processor – Executes programs
- Main Memory – Holds program and data
- I/O – For communication and data

Processor				MEMORY

Control Unit | **ALU** | **PC** / **IR** | **RF**

Interconnect

I/O Devices | **I/O Devices** | **I/O Devices**

Inside the Processor

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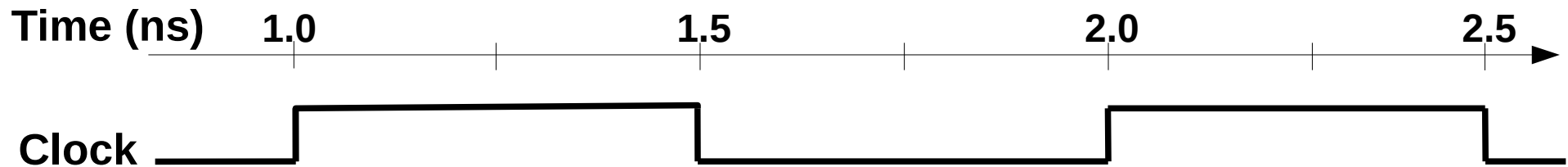 - Period = Cycle time

$$Cycle\ Time = \frac{1}{Frequency}$$

Clock Cycle

- Clock is a special signal to hardware

- A well defined indication for event start and complete.

Clock Cycle

- Clock is a special signal to hardware

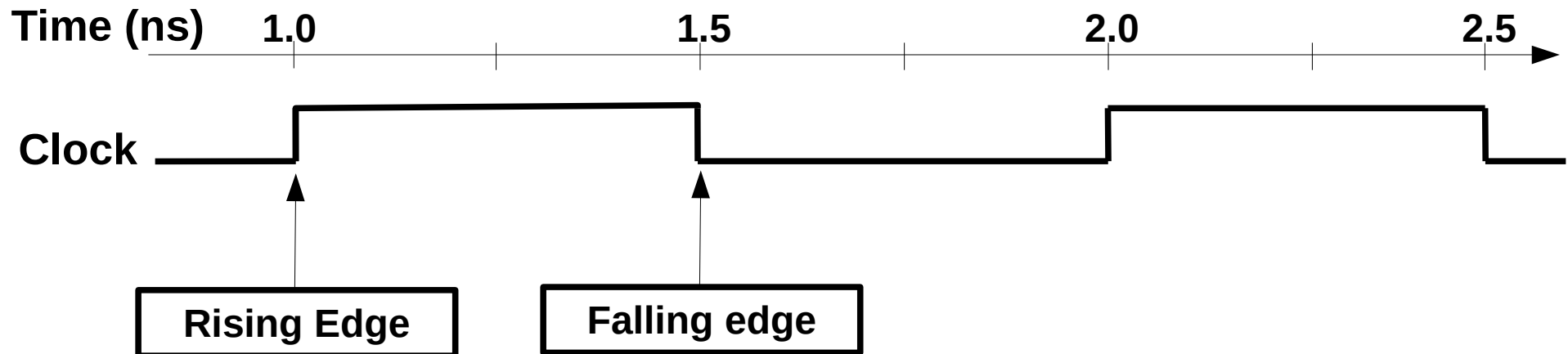- A well defined indication for event start and complete.

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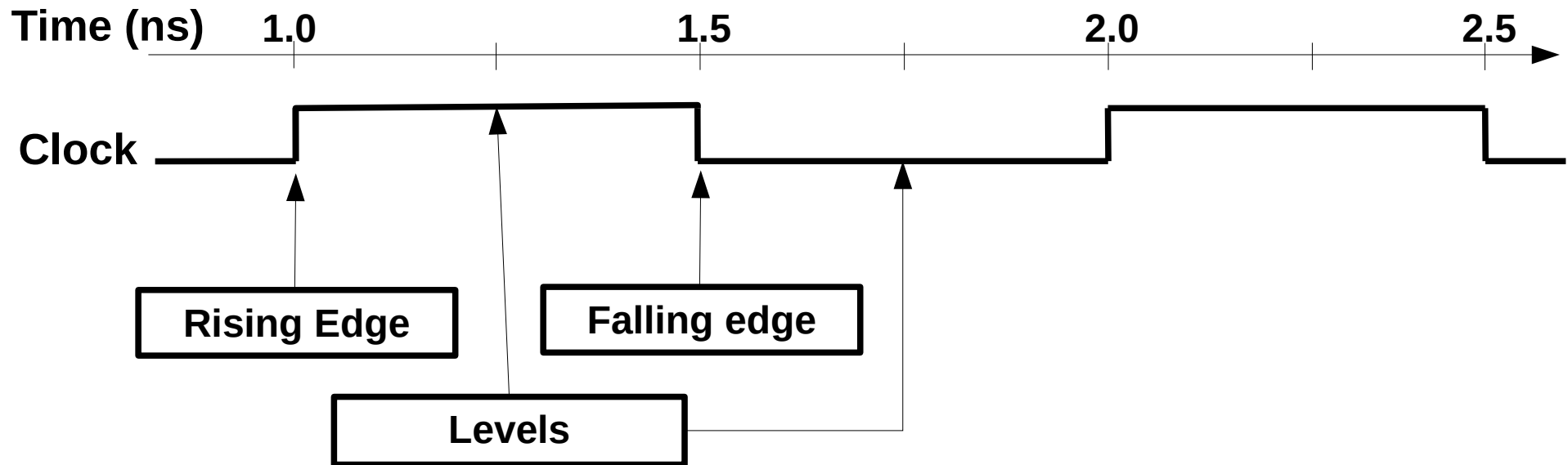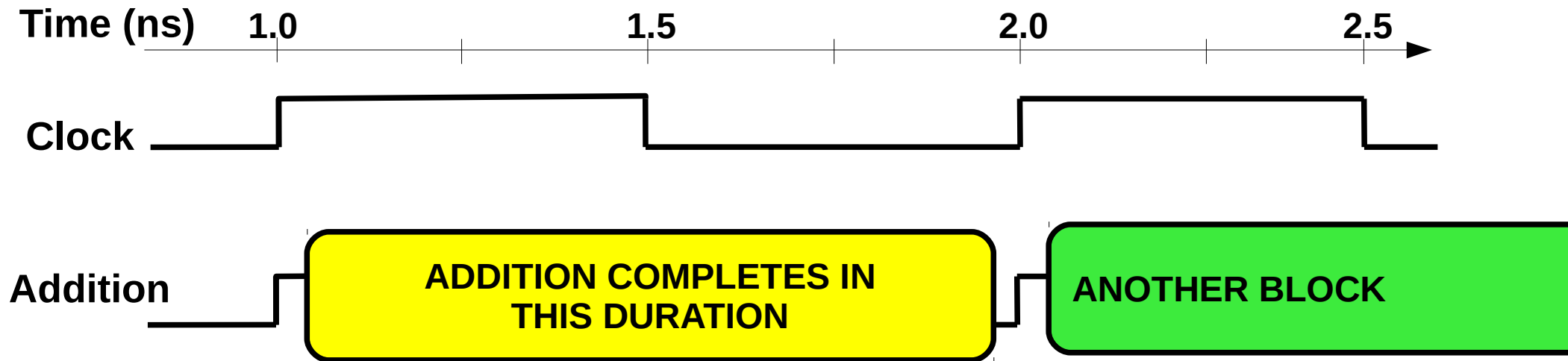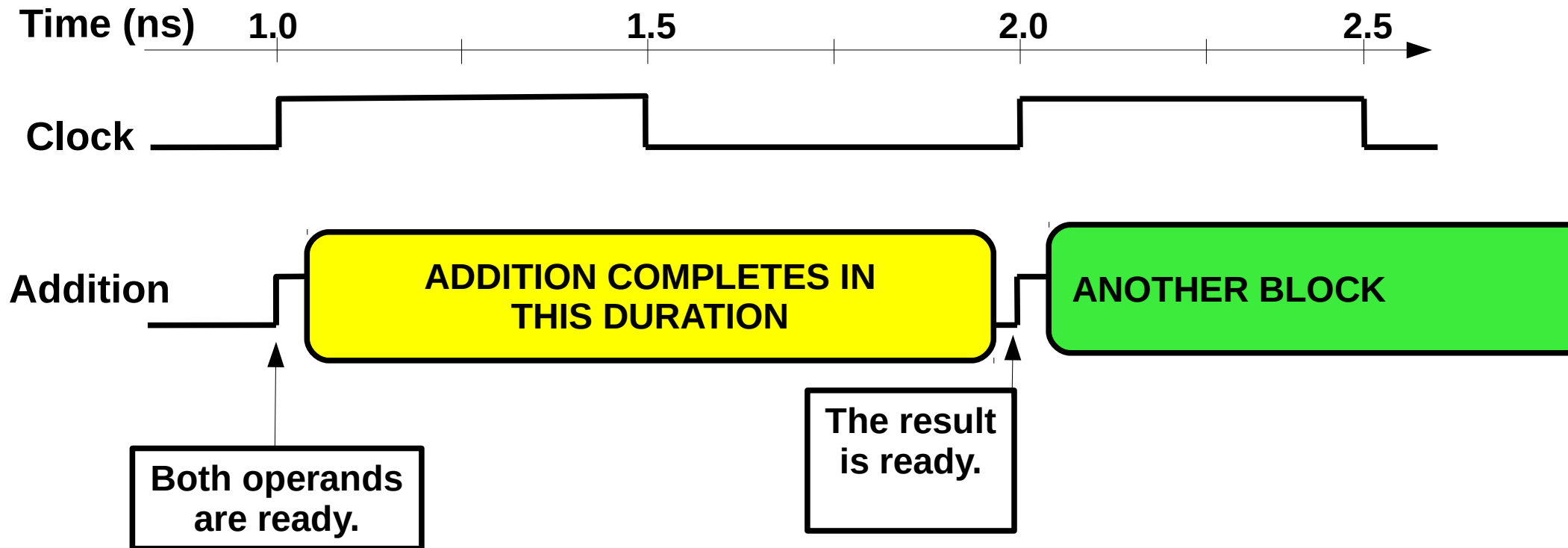- A well defined indication for event start and complete.

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Clock

Rising Edge

Falling edge

Levels

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Clock

Addition

ADDITION COMPLETES IN THIS DURATION

ANOTHER BLOCK

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Clock

Addition
┌─────────────────────────────────┐
│ ADDITION COMPLETES IN   │   **ANOTHER BLOCK**
│ THIS DURATION   │
└─────────────────────────────────┘

The result is ready.

Both operands are ready.

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Clock Cycle

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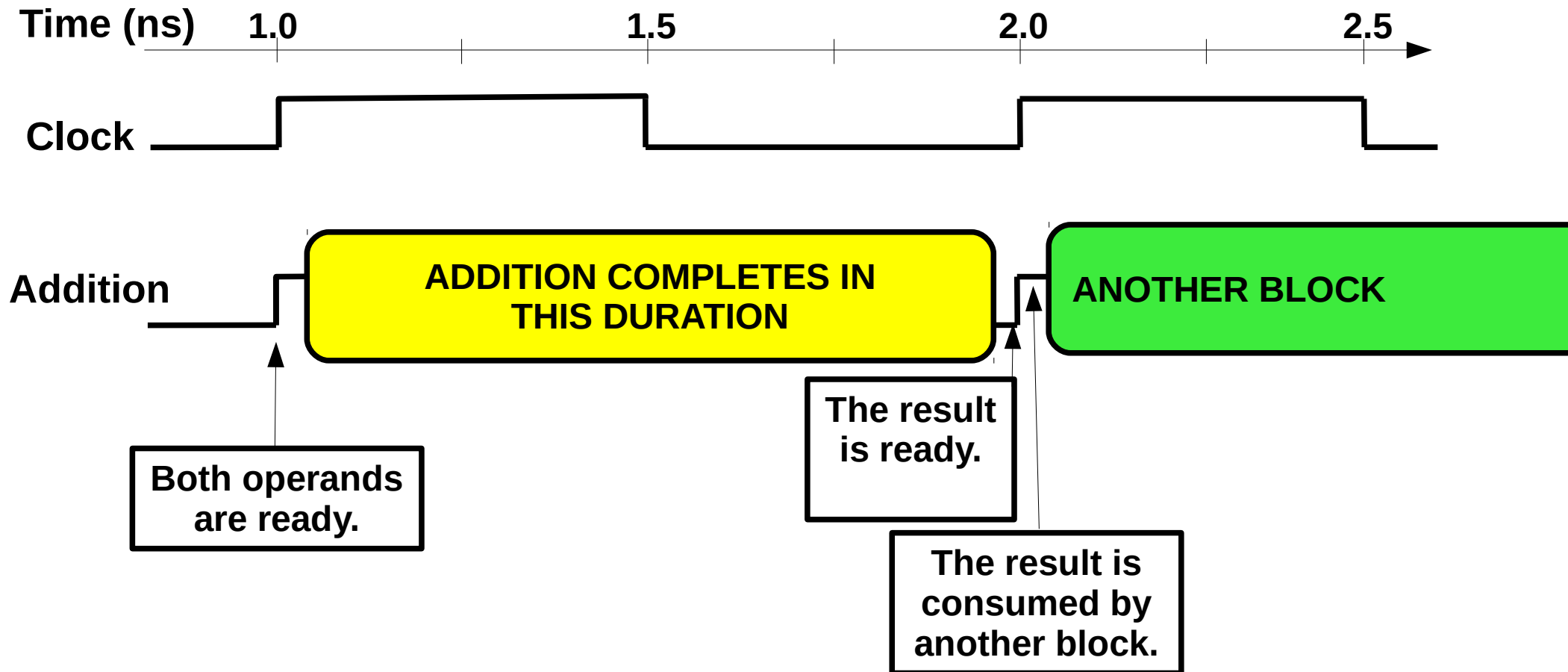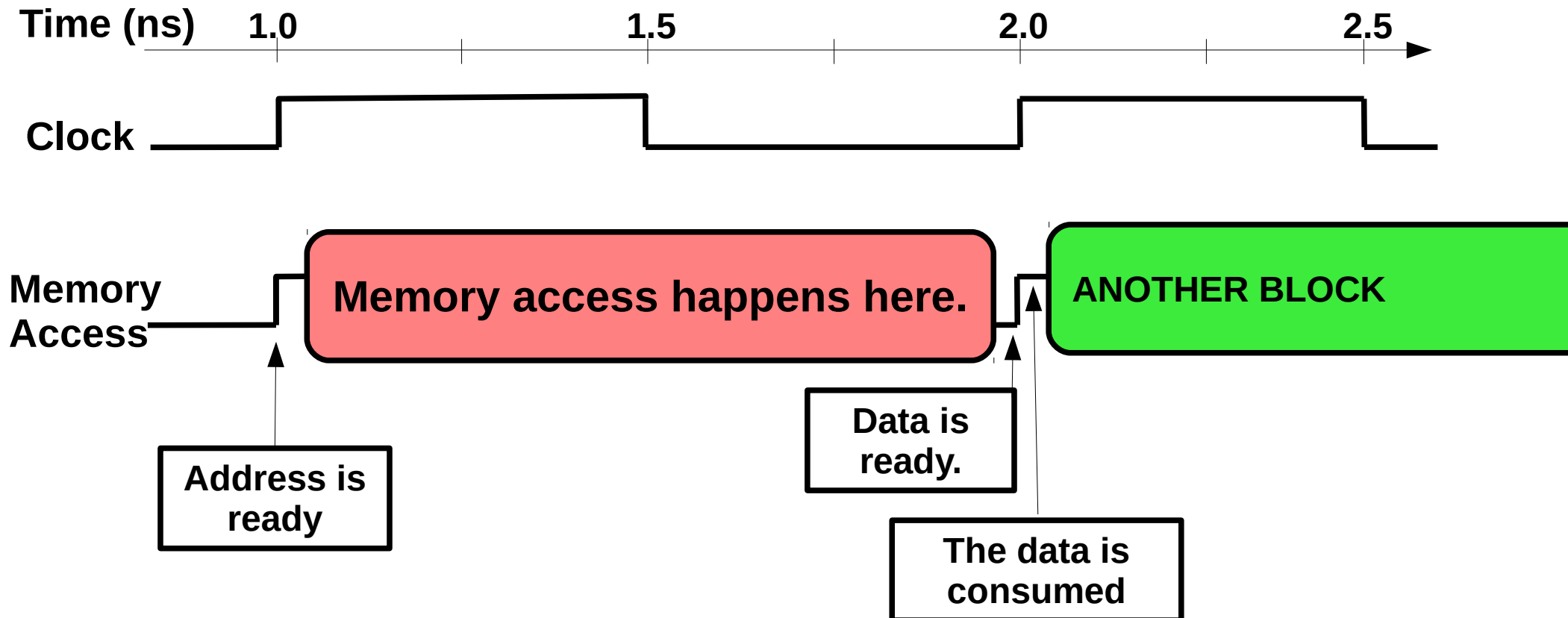- A well defined indication for event start and complete.

Time (ns)   1.0   1.5   2.0   2.5

Clock

Memory Access

Memory access happens here.

ANOTHER BLOCK

Address is ready

Data is ready.

The data is consumed

On Processor Performance

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Example

What is the execution time of a program containing a million instructions each occupying 4 cycles in a 2 GHz processor?

Iron Law of Processor Performance

$$CPU\ Time = IC \times Cycles\ per\ Instruction \times Cycle\ Time$$

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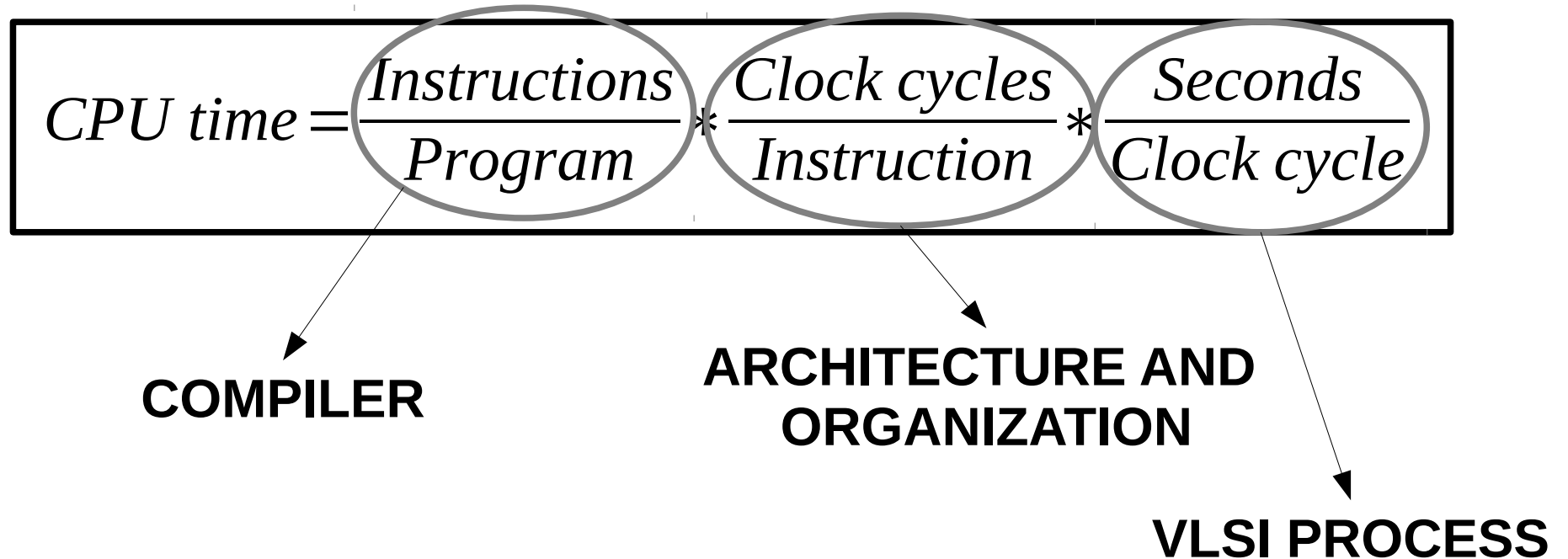
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COMPILER

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COMPILER

ARCHITECTURE AND ORGANIZATION

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COMPILER

ARCHITECTURE AND ORGANIZATION

VLSI PROCESS

Summary

- Inside the processor, system
- Frequency, Clock cycle
- IPC, CPI
- Iron Law of Processor Performance

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