PROGRAMMABLE LOGIC CONTROLLER

Control Systems Types

- Programmable Logic Controllers
- Distributed Control System
- PC- Based Controls

Programmable Logic Controllers

PLC

- Sequential logic solver
- PID Calculations.
- Advanced Subroutines
- BIT Operations.
- Data Transfer.
- Text Handling.

Programmable Logic Controllers

Applications :

- Machine controls, Packaging, Palletizing, Material handling, similar Sequential task as well as Process control

Advantages of PLC :

- They are fast and designed for the rugged industrial environment.
- They are attractive on Cost-Per-Point Basis.
- These Devices are less Proprietary (E.g.. Using Open Bus Interface.)
- These Systems are upgraded to add more Intelligence and Capabilities with dedicated PID and Ethernet Modules.

Disadvantages of PLC :

- PLC were Designed for Relay Logic Ladder and have Difficulty with some Smart Devices.
- To maximize PLC performance and Flexibility, a number of Optional Modules must be added

Programmable Logic Controllers

PLC Types

- Nano (Small)
- Micro (Medium)
- Large

Basic criteria for PLC Types

- Memory Capacity
- I/O Range
- Packaging and Cost per Point

Programmable Logic Controllers

Components

- Central Processing Unit (CPU)
- Input Output Modules
- Power Supply
- Bus system

Programmable Logic Controllers

Central Processing Unit

- It is a micro-controller based circuitary. The CPU consists of following blocks :

  Arithmatic Logic Unit (ALU), Program memory

  Process image memory (Internal memory of CPU)

  Internal timers and counters

  Flags

- CPU performs the task necessary to fulfill the PLC funtions. These tasks include Scanning, I/O bus traffic control, Program execution, Peripheral and External device communication, special functions or data handling execution and self diagnistics.

Programmable Logic Controllers

Input module

- These modules act as interface between real-time status of process variable and the CPU.
- Analog input module : Typical input to these modules is

  4-20 mA, 0-10 V

  Ex : Pressure, Flow, Level Tx, RTD (Ohm), Thermocouple (mV)
- Digital input module : Typical input to these modules is 24 V DC, 115 V AC, 230 V AC

  Ex. : Switches, Pushbuttons, Relays, pump valve on off status

Programmable Logic Controllers

Output module

- These modules act as link between the CPU and the output devices in the field.
- Analog output module : Typical output from these modules is 4-20 mA, 0-10 V

  Ex : Control Valve, Speed, Vibration
- Digital output module : Typical output from these modules is 24 V DC, 115 V AC, 230 V AC

  Ex. : Solenoid Valves, lamps, Actuators, dampers, Pump valve on off control

Programmable Logic Controllers

Power Supply

- The power supply gives the voltage required for electronics module (I/O Logic signals, CPU, memory unit and peripheral devices) of the PLC from the line supply.
- The power supply provides isolation necessary to protect the solid state devices from most high voltage line spikes.
- As I/O is expanded, some PLC may require additional power supplies in order to maintain proper power levels.

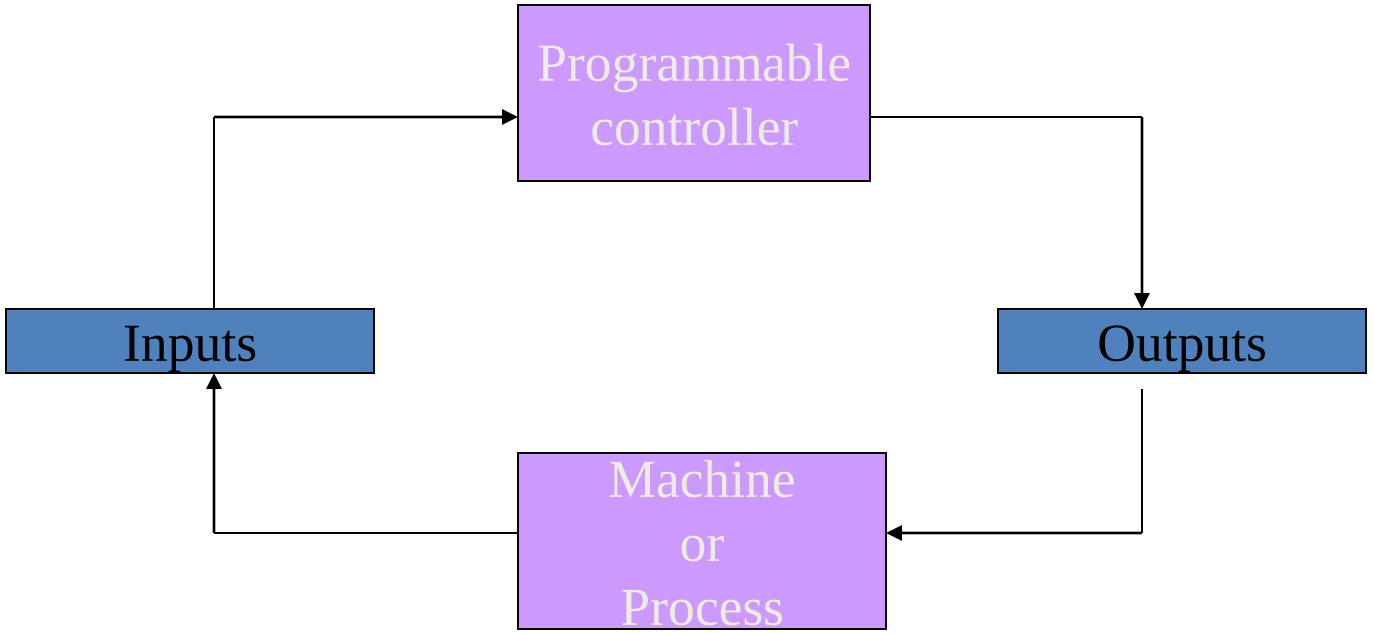
Programmable Logic Controllers

Bus System

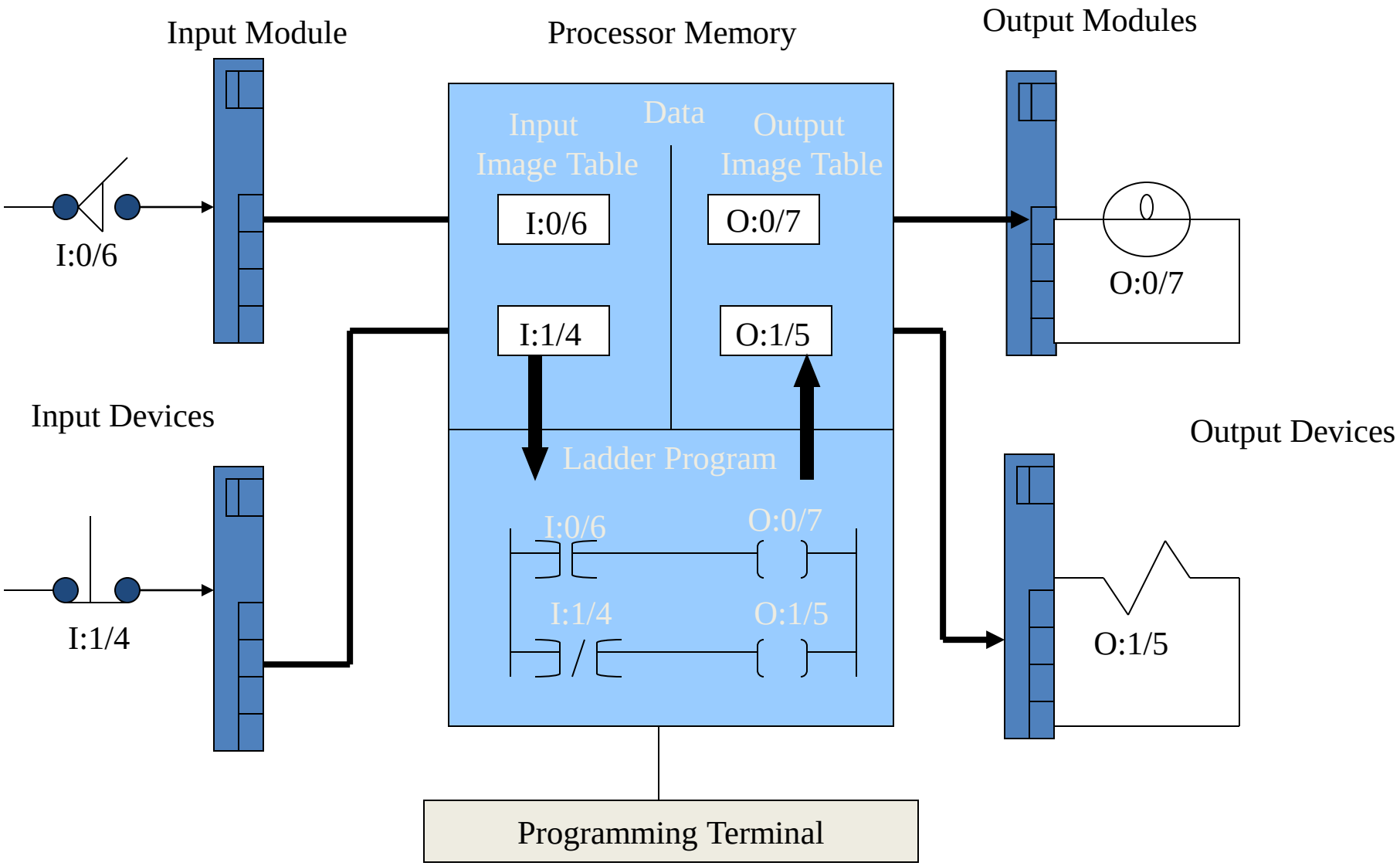
- It is path for the transmission of the signal . Bus system is responsible for the signal exchange between processor and I/O modules
- The bus system comprise of several single line ie wires / tracks

PLC Cycle

- Sense the Input
- Process the Logic
- Give Output

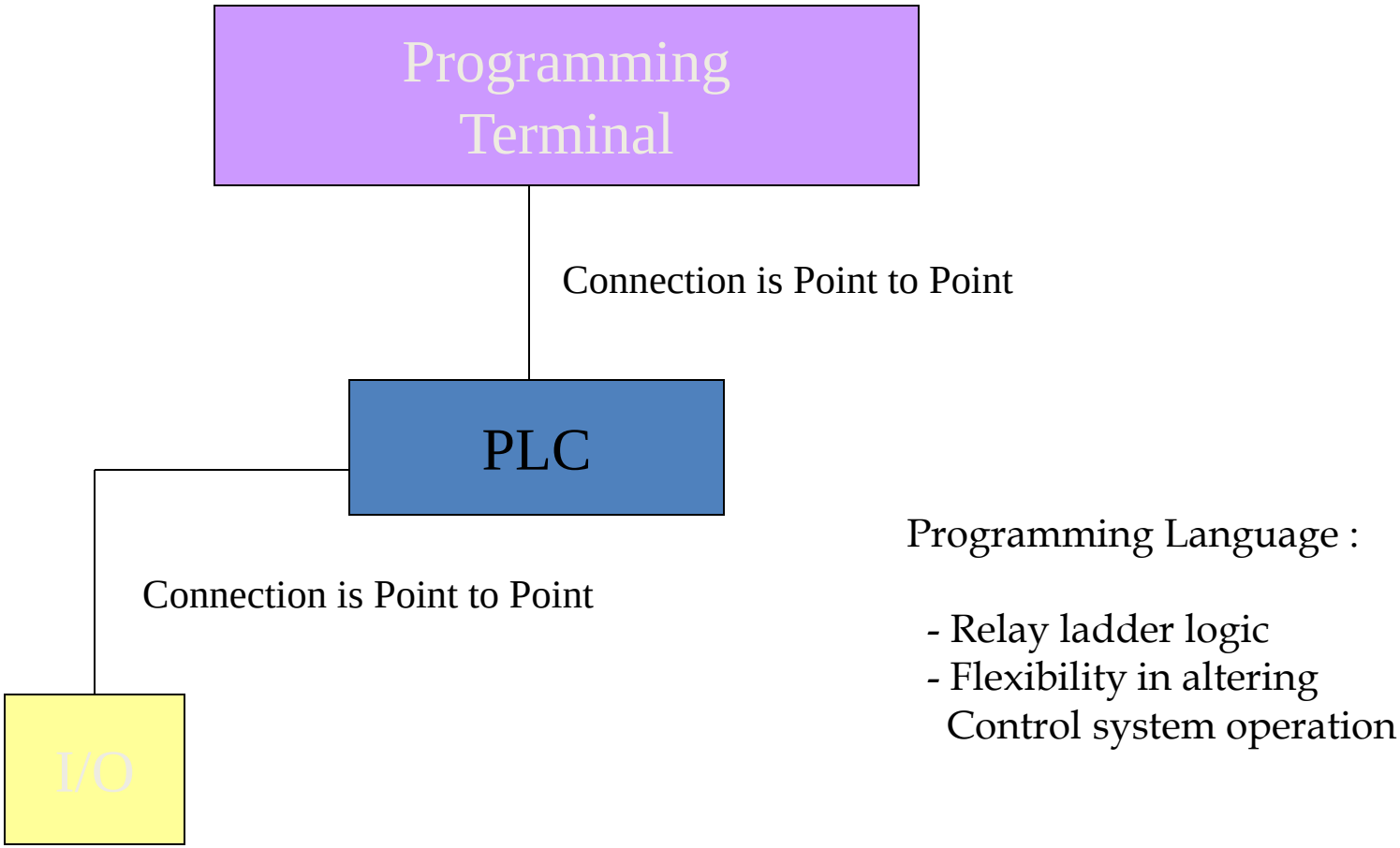


PLC Signal Flow



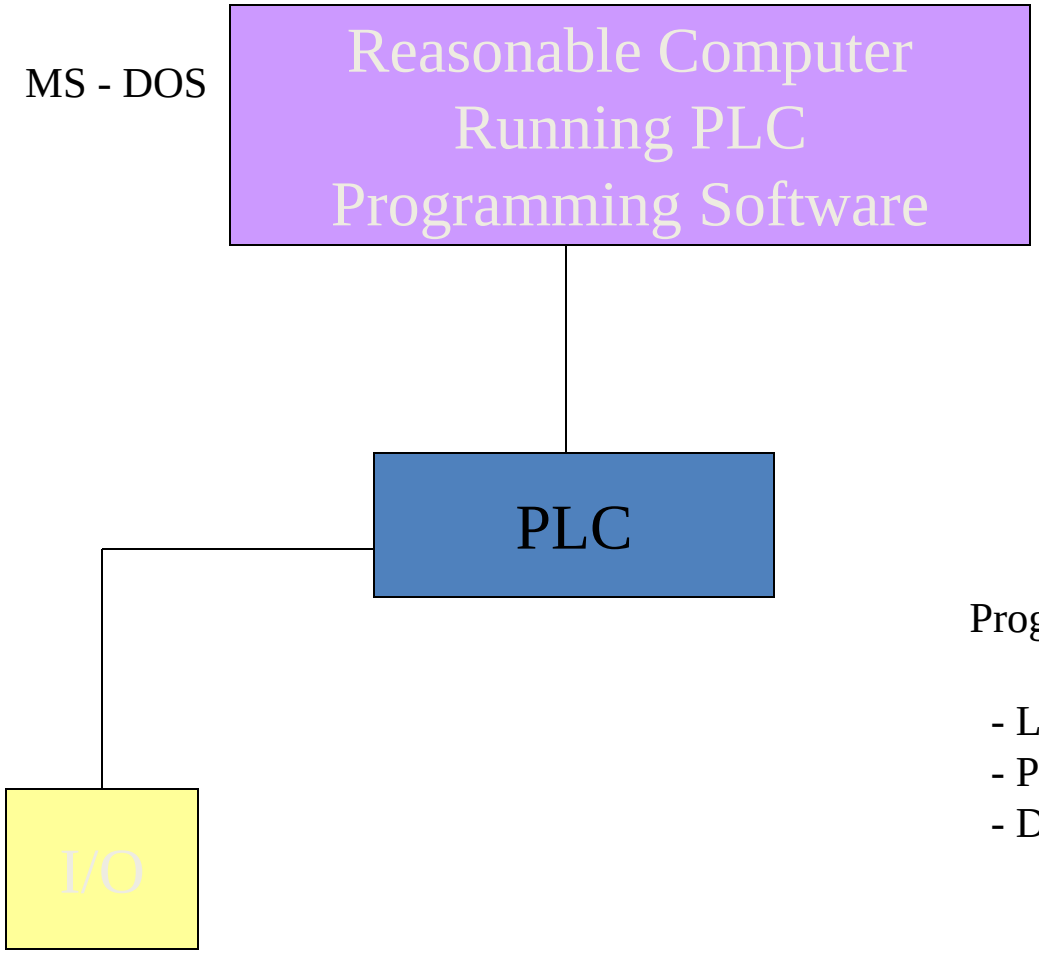
PLC Architecture Evolution

- Mid - 1970s : Discrete Machine Control



PLC Architecture Evolution

- Early - to - Mid 1980 : Discrete and Process Control

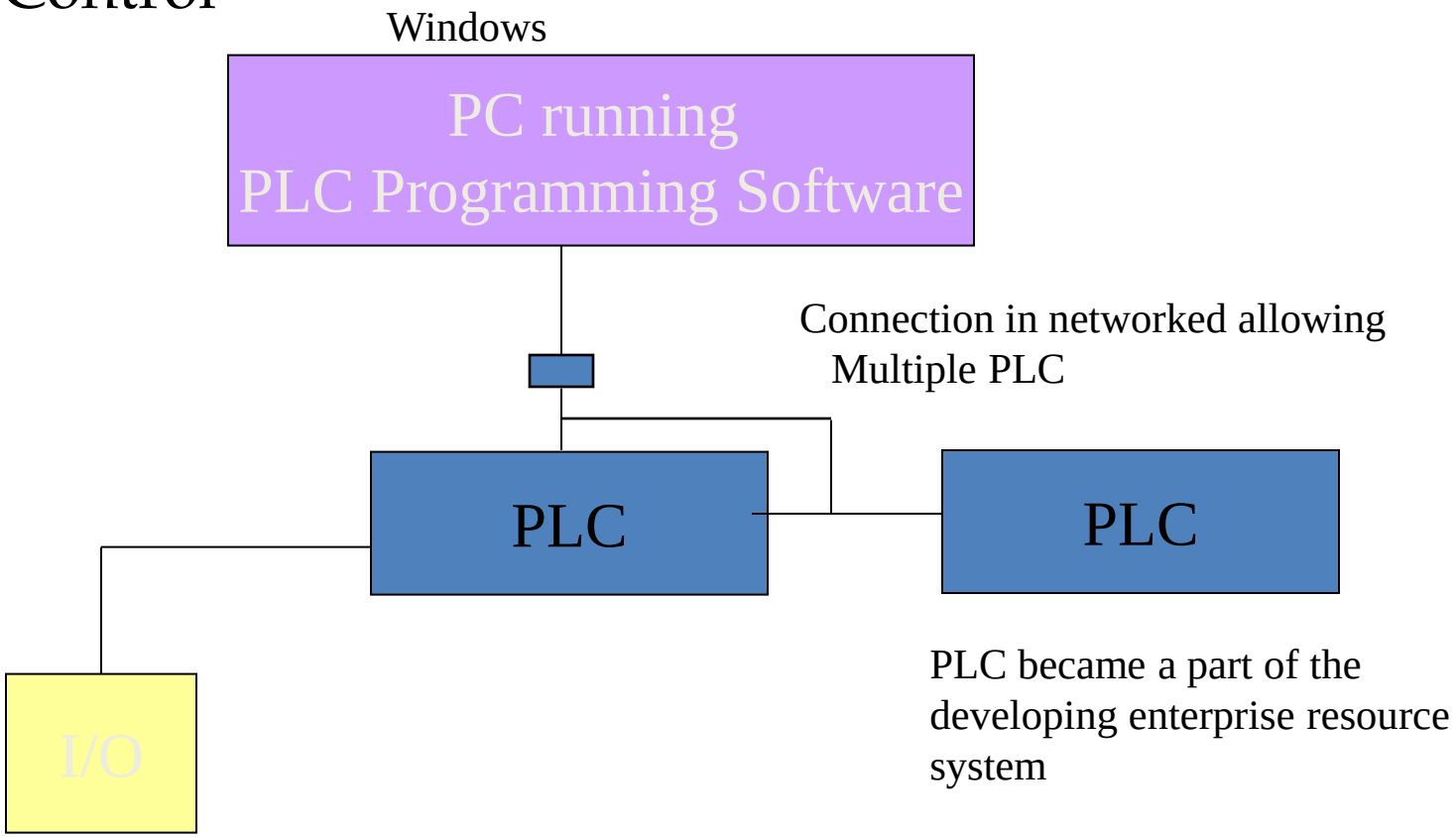


Programming Language :

- Ladder Program
- PID
- Data Storage

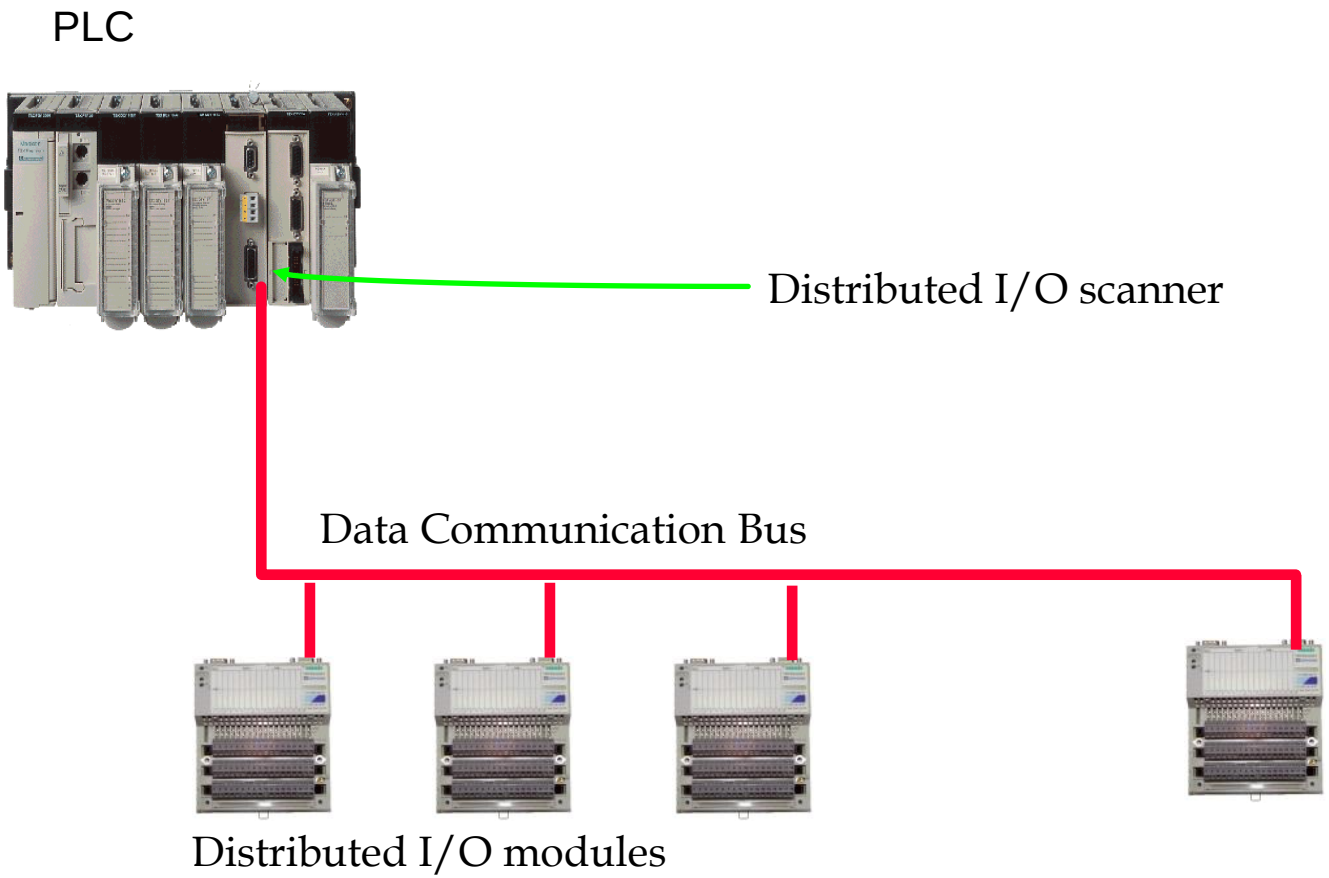
PLC Architecture Evolution

- Late 1980's to early 1990's : Discrete and Process Control



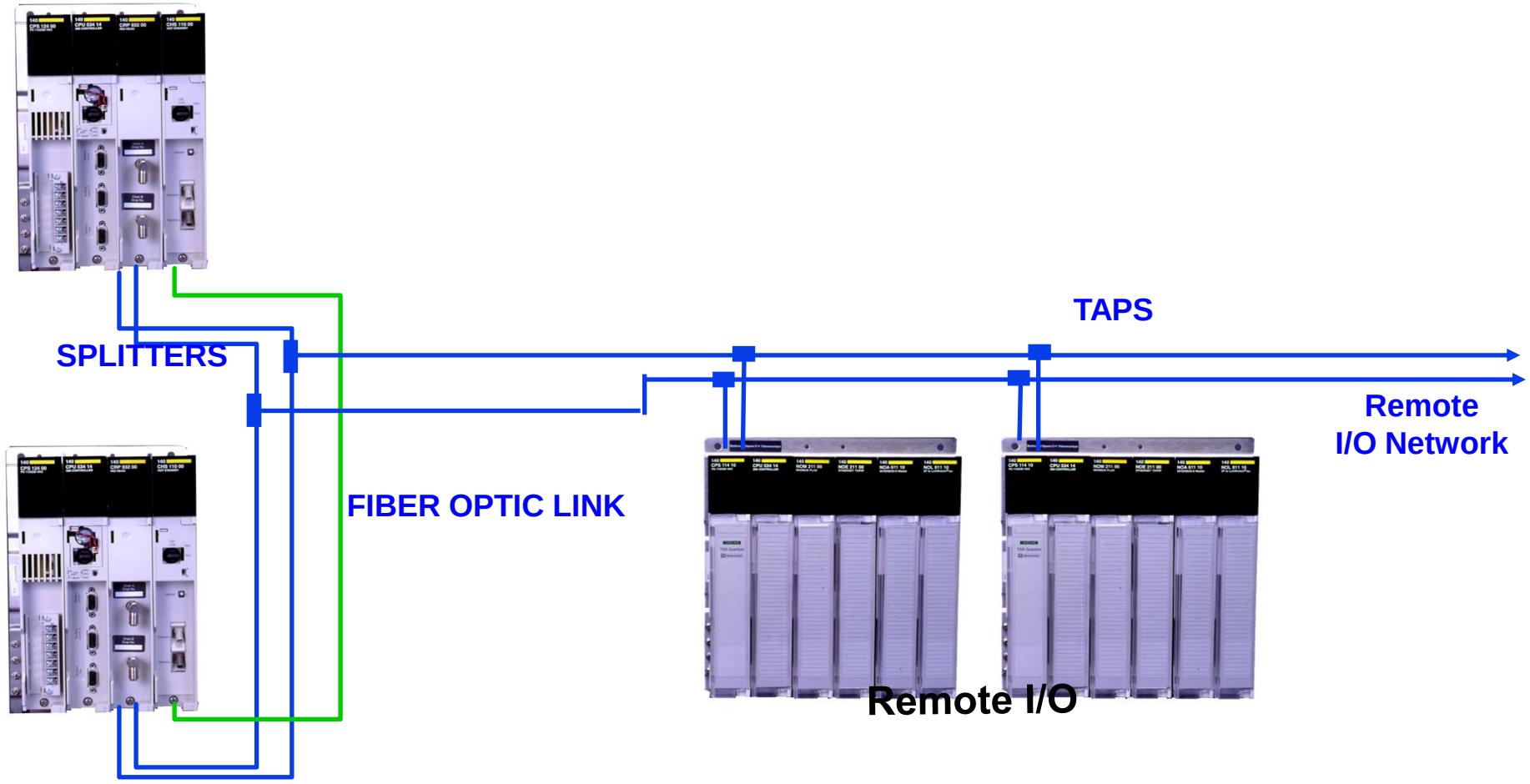
PLC Architecture Evolution

Today : Distributed I/O Modules



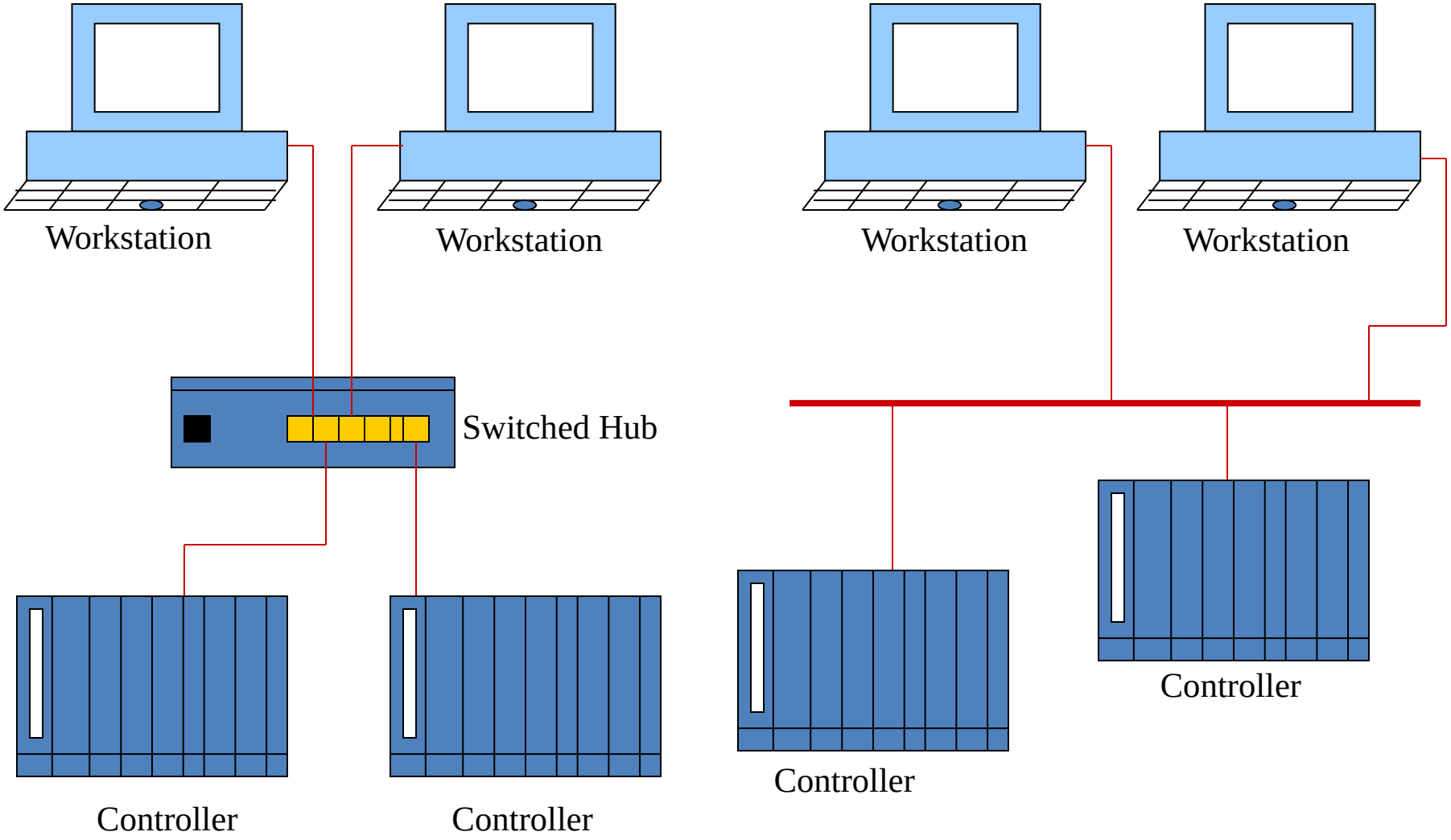
PLC Architecture Evolution

Today : Hot Redundant System



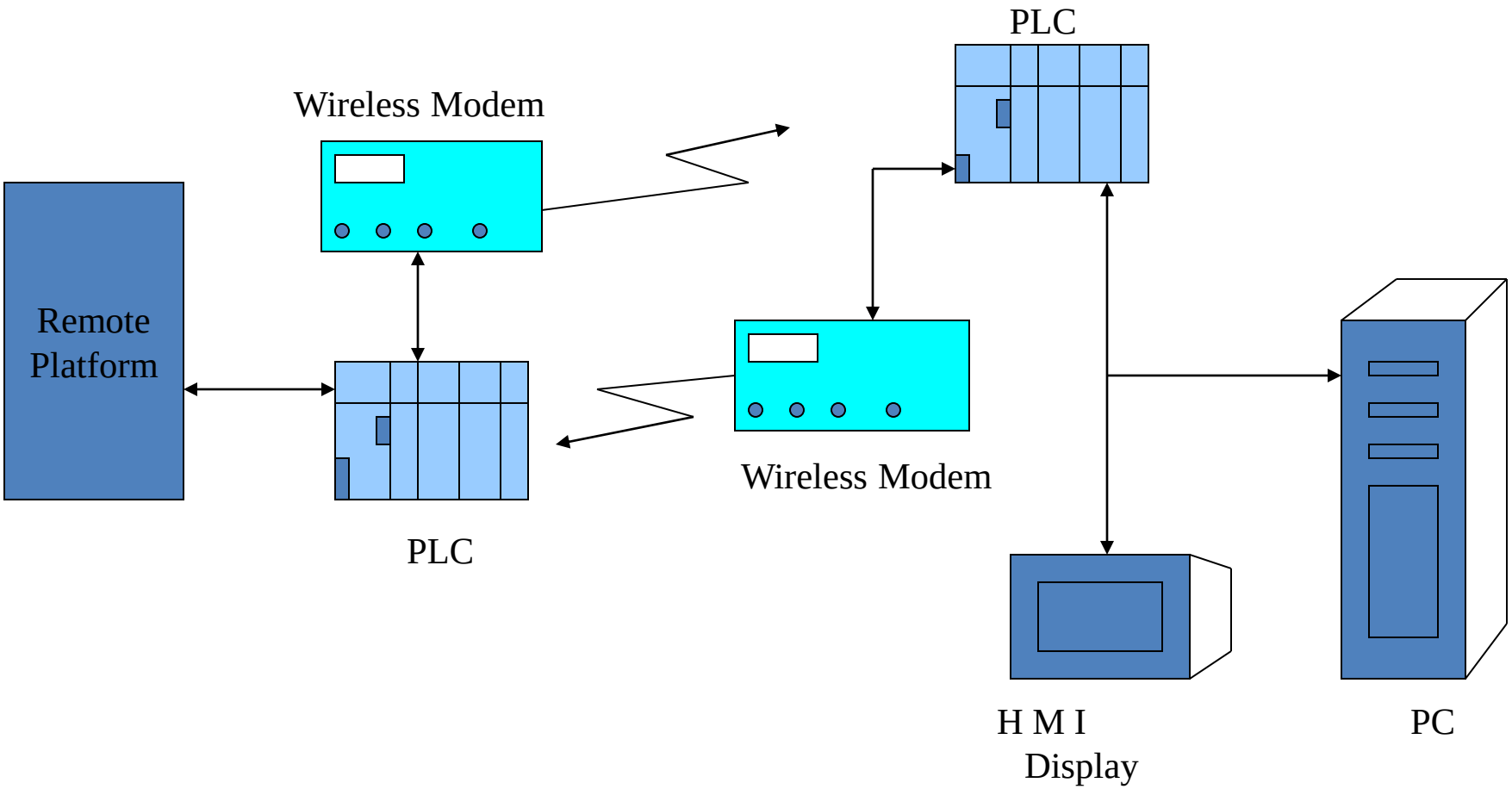
PLC Architecture Evolution

Today : Ethernet Technology in PLCs



PLC Architecture Evolution

Today : Wireless communication



PLC Systems of various vendors

Siemens

- S5 -110U, 115U, 135U
- S7 - 200, 300, 400

Allen Bradley

- Micrologix 1000, 1200, 1500
- SLC 5/01, 5/02, 5/03
- PLC 5/10, 5/25 and 5/40

Modicon

- Nano
- Micro
- Premium
- Quantum

Configuration of PLC : Modicon

Built in display for I/O (in-rack, AS-i) and Diag

Programming Terminal PC Connection

8 Analog Inputs 1 Analog Output

I/O Modules

Up/Down Fast Counter

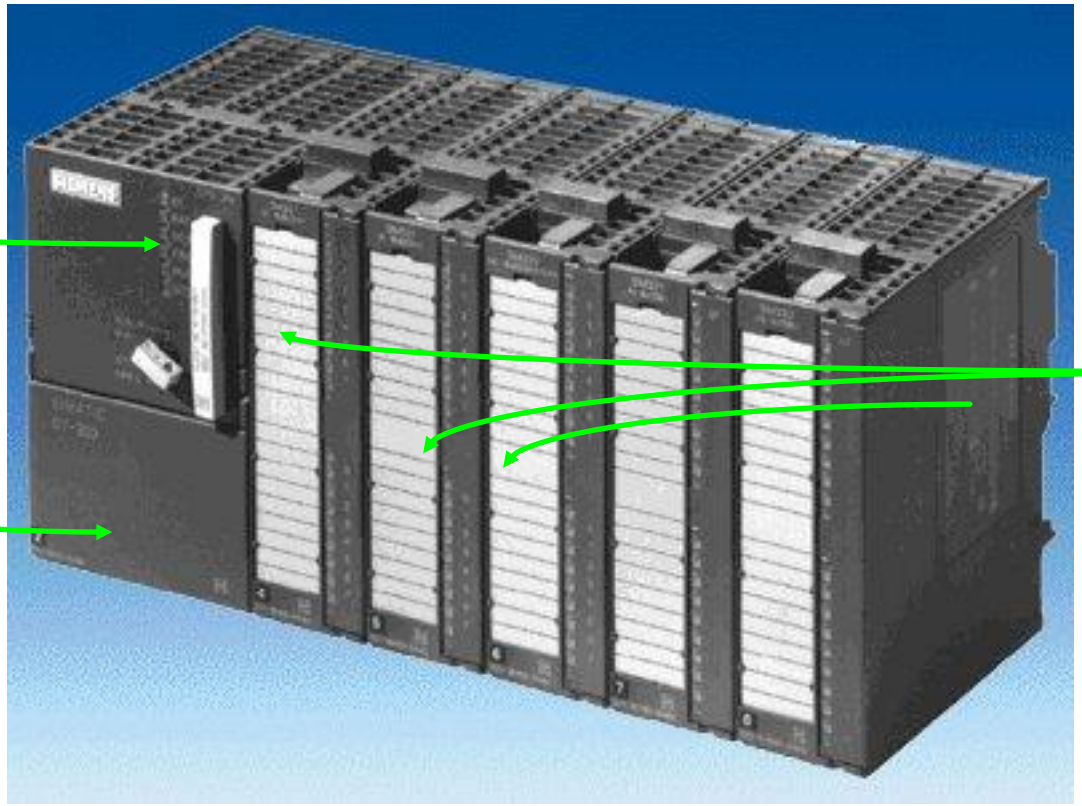
Up Counter

Unitelway Port for connection of up to 5 Slaves

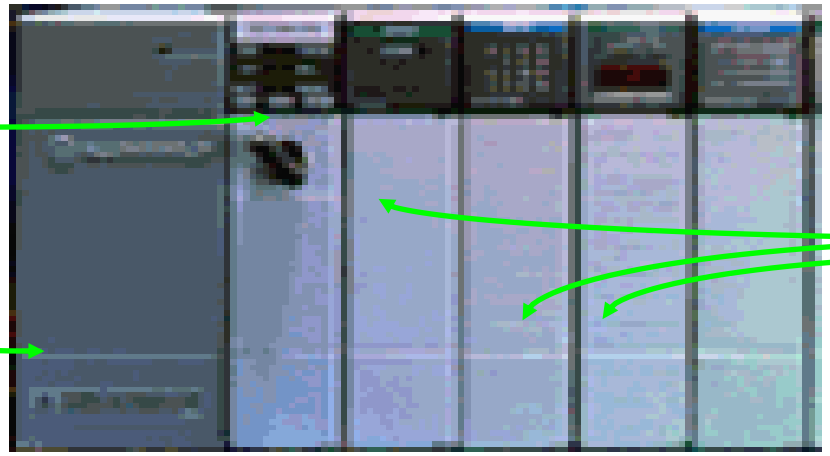
PCMCIA communications port

PCMCIA memory expansion port

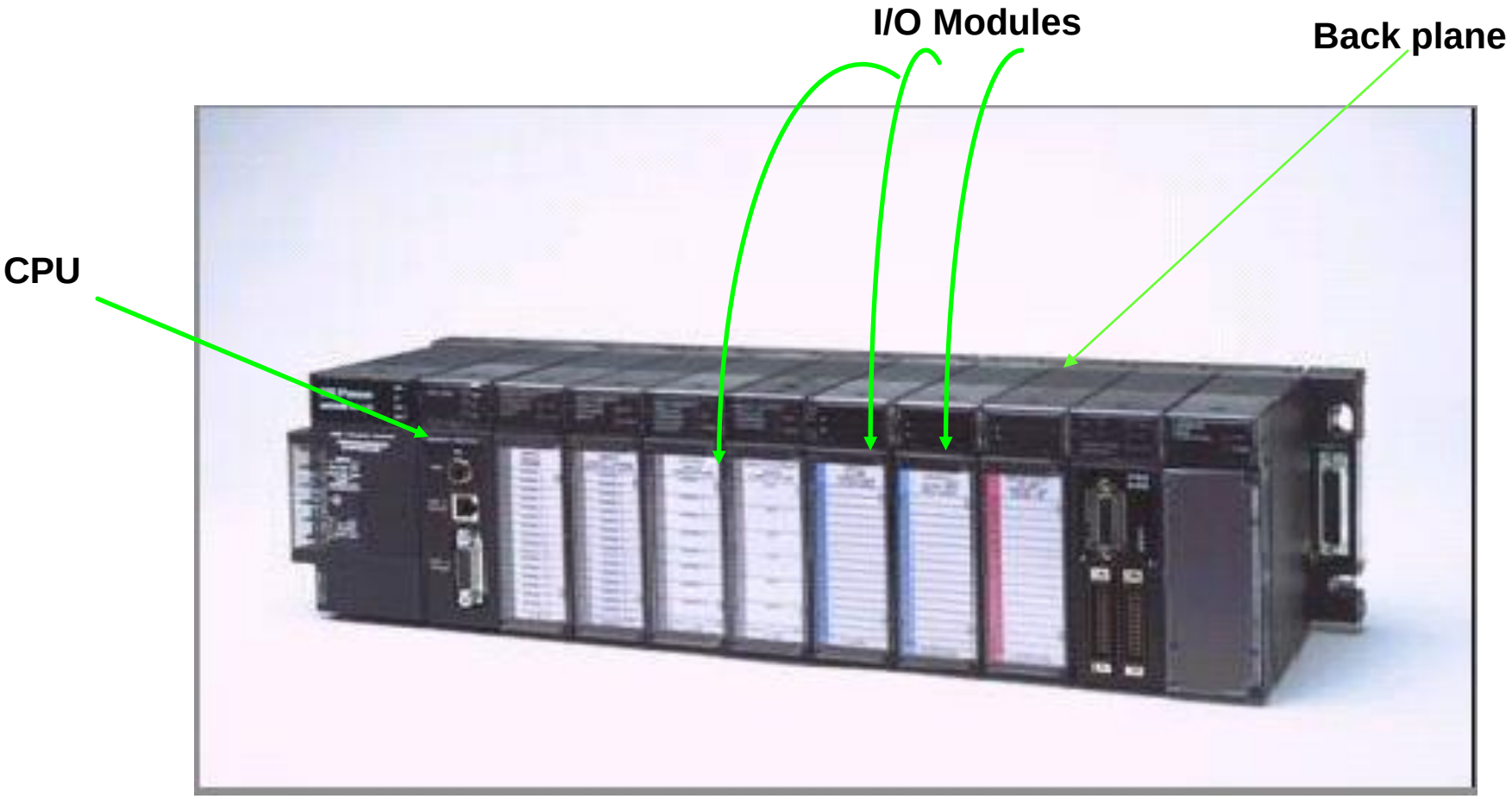
Configuration of PLC : Siemens



Configuration of PLC : Allen Bradley



Configuration of PLC : GE FANUC



PLC Programming Standards

The open, manufacturer-independent programming standard for automation is IEC 61131-3. You can thus choose what configuration interface you wish to use when writing your application :

- Ladder Diagram
- Instruction List
- Function Block Diagram
- Sequential Function Chart
- Structured Text