FPGA

- SPLDs and CPLDs are relatively small and useful for simple logic devices
  - Up to about 20000 gates
- Field Programmable Gate Arrays (FPGA) can handle larger circuits
  - No AND/OR planes
  - Provide logic blocks, I/O blocks, and interconnection wires and switches
  - Logic blocks provide functionality
  - Interconnection switches allow logic blocks to be connected to each other and to the I/O pins

# Field Programmable Logic Devices (FPGAs)

- Gate arrays are non-programmable devices that can be manufactured more cheaply than other types of IC, because they contain a standard grid of logic gates whose interconnections are specified by the customer.

- When a customer orders a new type of chip, the manufacturer does not have to design it from scratch, but can just take a standard gate array and modify it to the customer's requirement.

Field Programmable Logic Devices (FPGAs)

- FPGAs use a similar grid of logic gates, but the programming is done by the customer, not by the manufacturer.

- The term "field-programmable" may be obscure to some, but the "field" is just an engineering term for the world outside the factory where customers live.
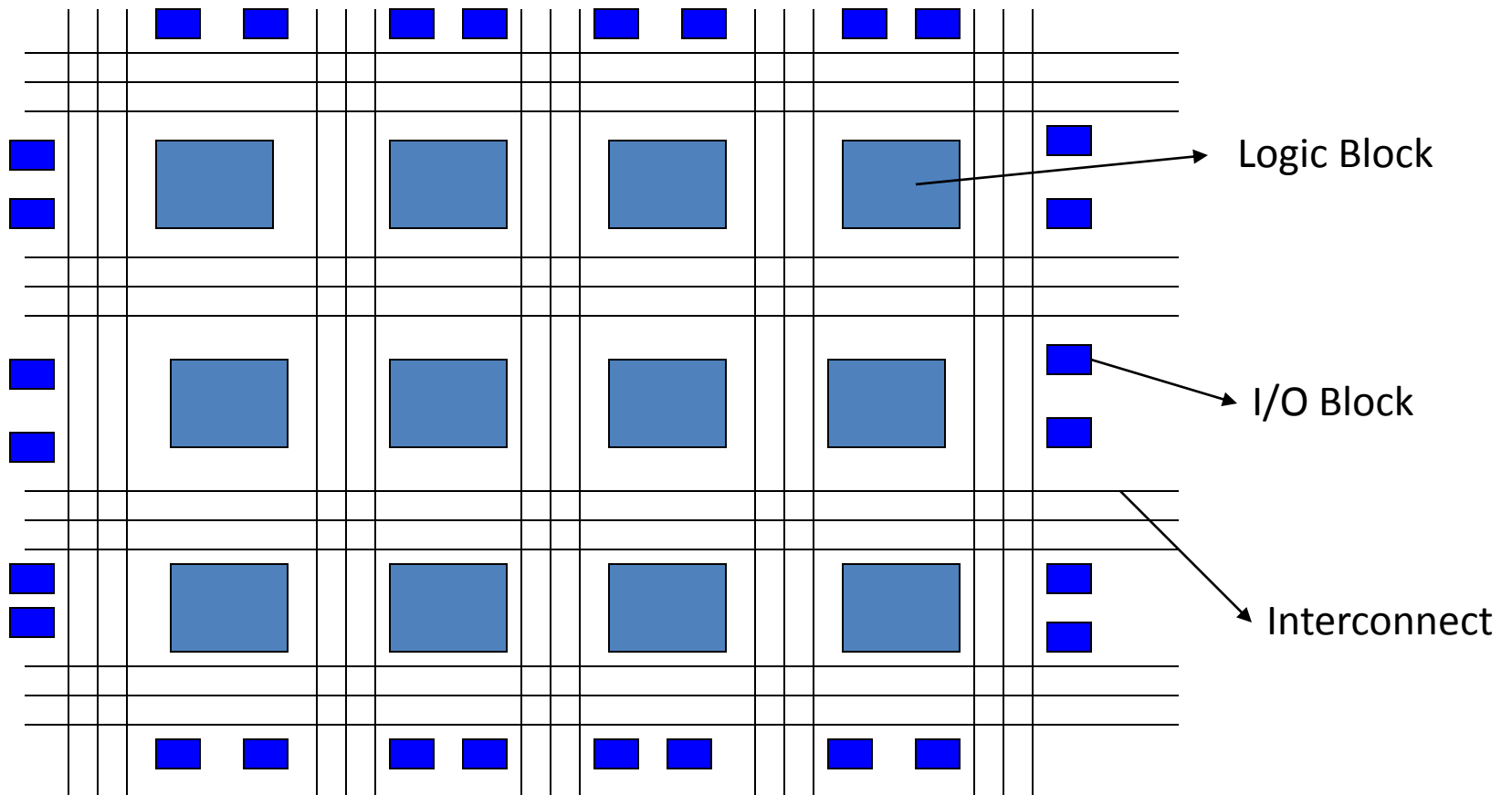
General FPGA Architecture

- Field Programmable Gate Array

Programmable I/O blocks
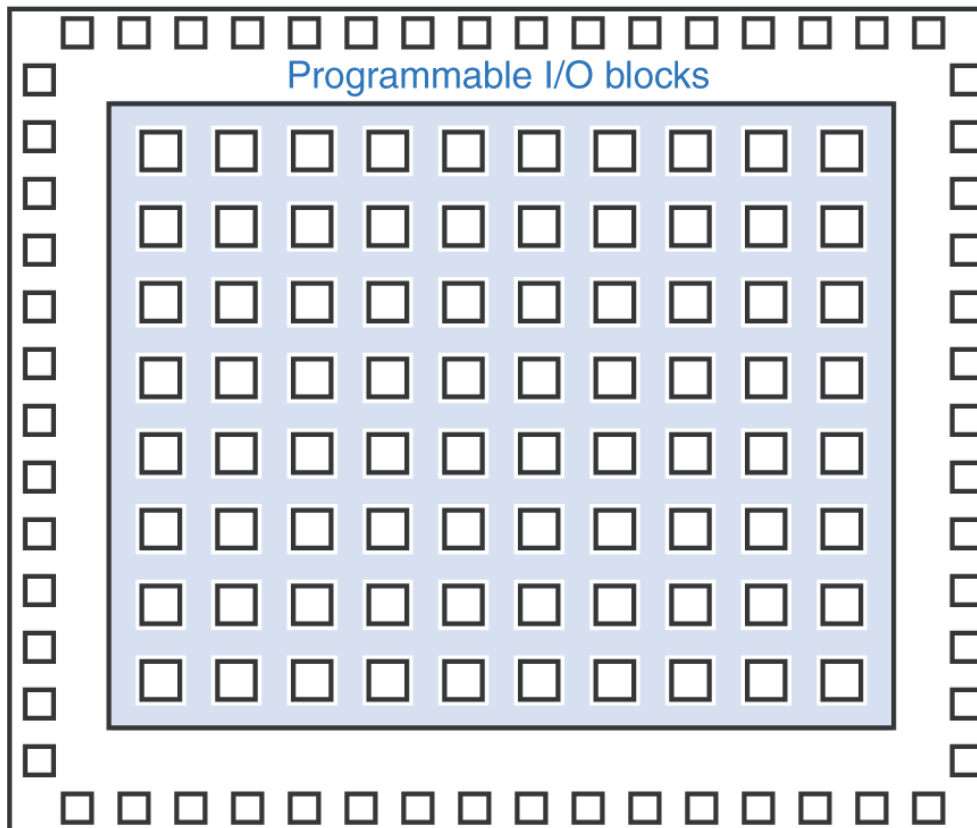
= Programmable interconnect

= Programmable logic block

= I/O pad

Structure of FPGA (Xilinx)

Logic Block

I/O Block

Interconnect

Programming an FPGA

– In System Programming method is used

- None of the other PLD technologies are volatile
- FPGA storage cells are loaded via a PROM when power is first applied

FPGA Types

- **2 types of FPGAs**
- **Reprogrammable (SRAM-based)**
  - Xilinx, Altera, Lattice, Atmel

- **One-time Programmable (OTP)**
  - Actel, Quicklogic

LUT   flip flop

SRAM logic cell

gates   flip flop
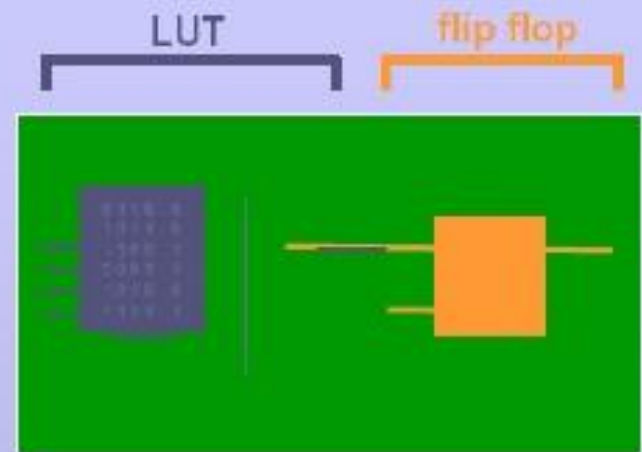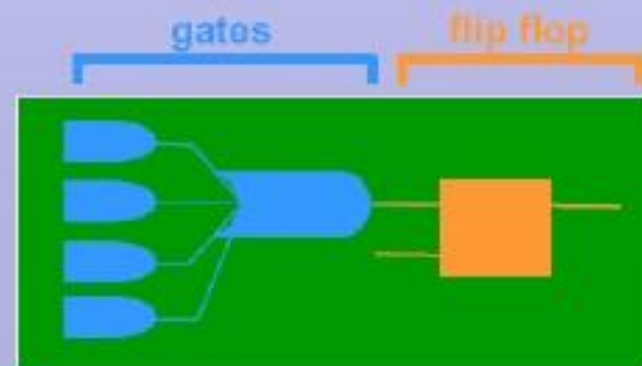
OTP logic cell

FPGA advantages

- Highly flexible
  - Control your design down to the individual gate level
  - Designs can be updated without rewiring
  - Quick turnaround during development
  - Easy to try alternative solutions
- Excellent real-time performance
  - No interrupt handler context switch overhead
  - Fully parallel operation

FPGA

■   FPGA applications:-

i.   DSP
ii.   Software-defined radio
iii.   Aerospace
iv.   Defense system
v.   ASIC
vi.   Medical Imaging
vii.   Computer vision
viii.   Speech Recognition
ix.   Bioinformatic
x.   And others.