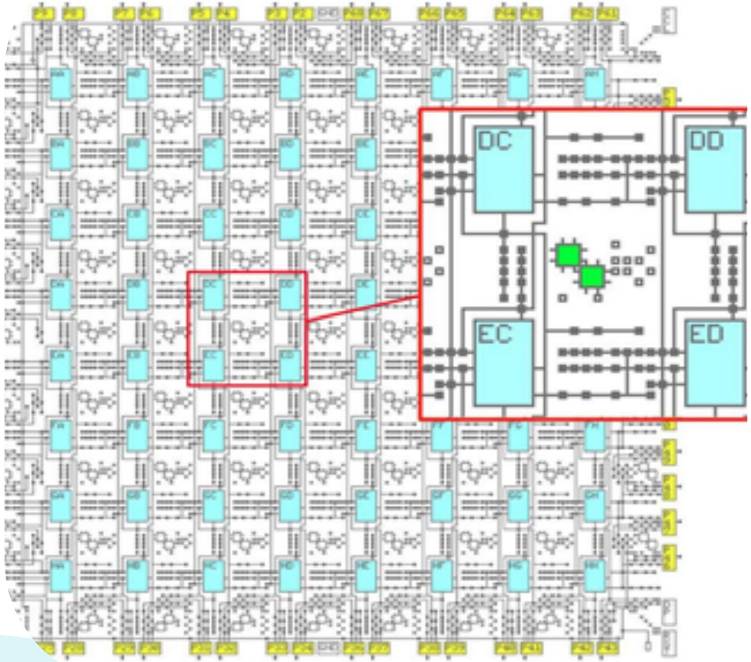
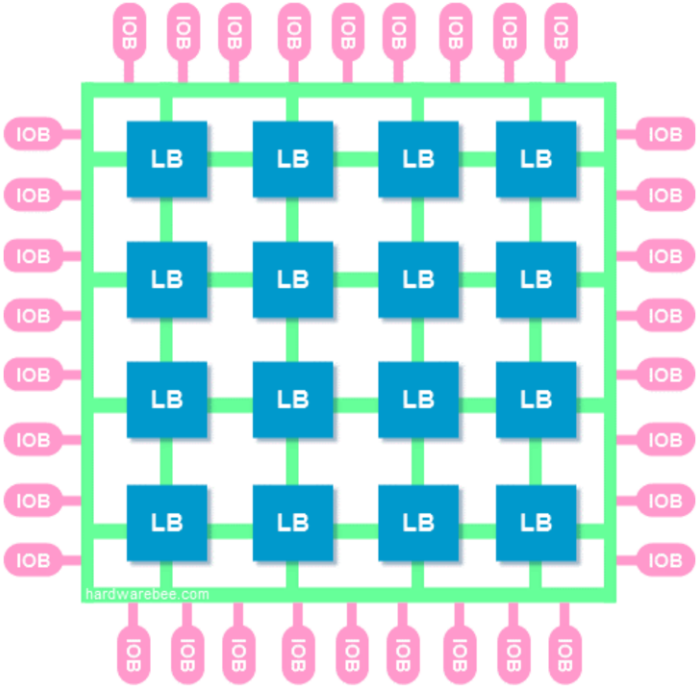
FPGA Architecture

The programmable read-only memory (PROM) and established programmable logic devices (PLD) gave rise to the FPGA industry by the 1980s (PROM). FPGA allowed programming to occur later in the process, even by the user, in contrast to PLD and PROM which had to be hardwired coded during manufacture. This allowed designers to add features (or cure flaws) after the product was deployed.

FPGA History

XC2064 First FPGA Architecture (1980s)





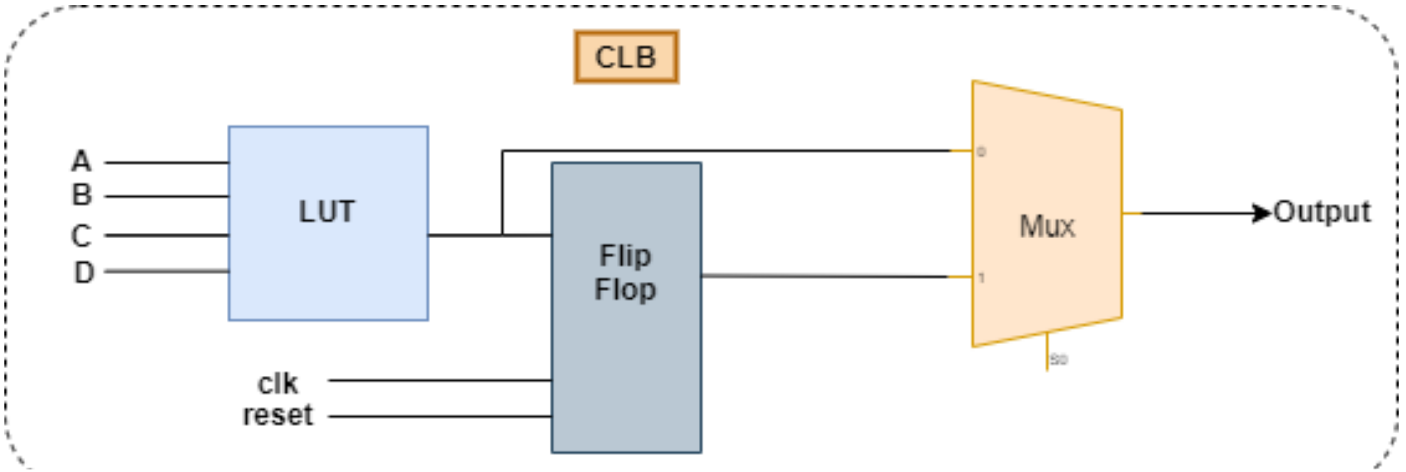
FPGA Architechture

1 — Configurable Logic Block

Interconnect Architecture — 2

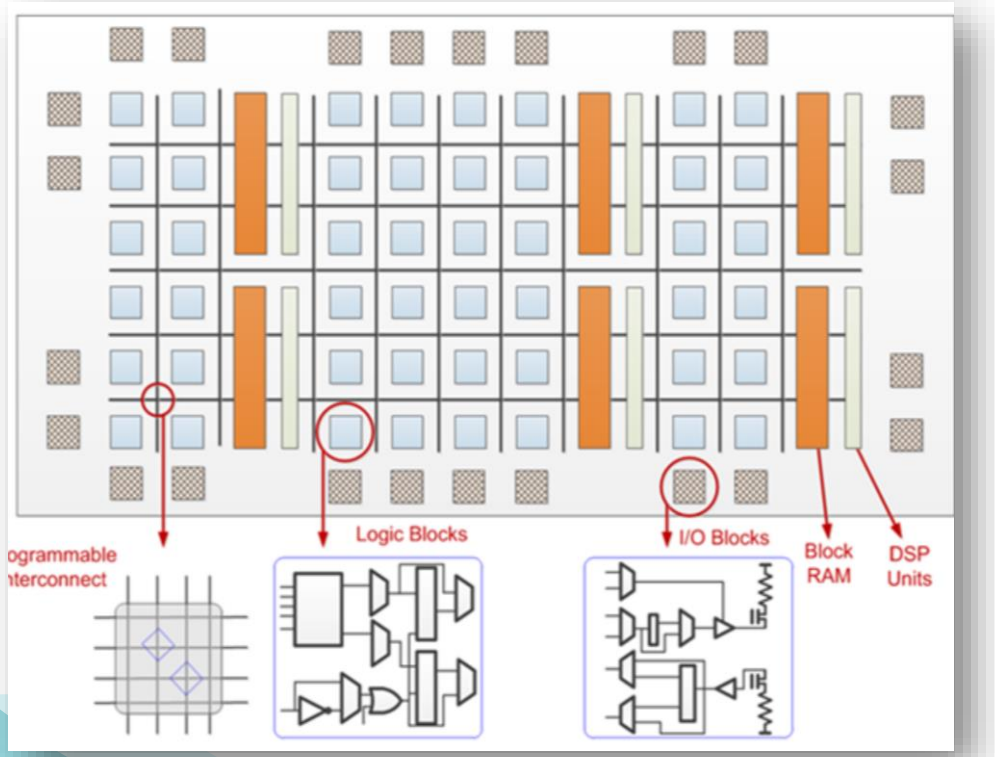
3 — Input/Output Block

Configurable Logic Block



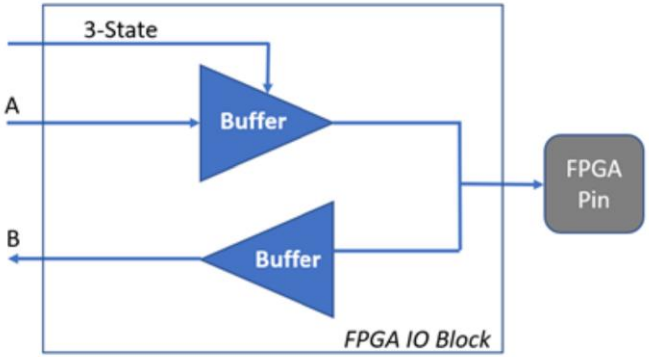
- **Look-up-Table:** One of the most important element in an FPGA architecture is the LUT – it's the core of the FPGA architecture. LUT is designed to implement any Boolean equation. Inside the LUT, there are multiplexers and the SRAM cells that contains the outputs based on the select lines.

Interconnect Architecture



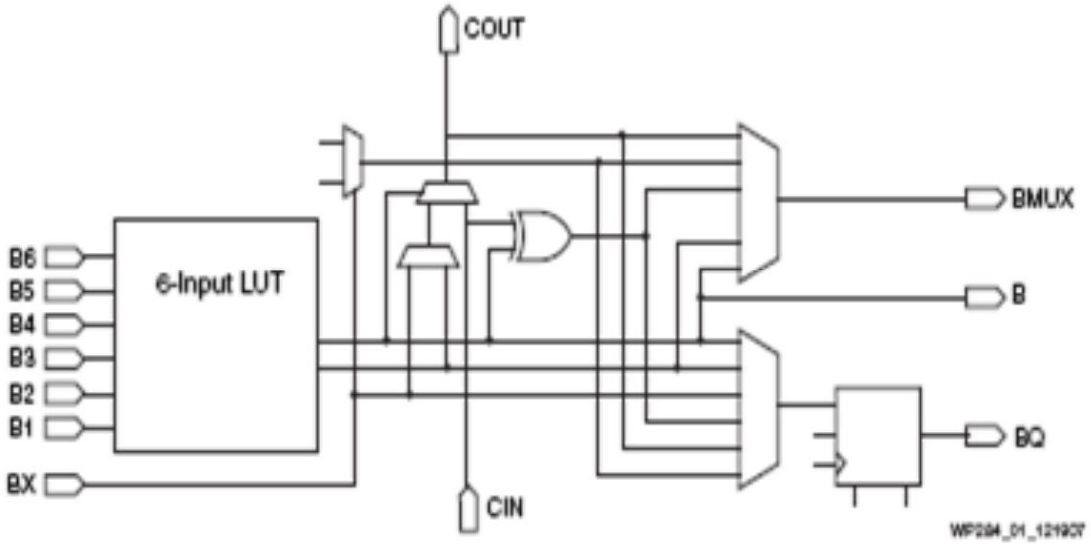
- Internal Routing: It is the route taken to connect your clock and all signals to the various FPGA components. This internal routing, which consists of channels made up of interconnecting wires and electrically changeable switches, connects the various logic blocks to one another.

Input/Output Block



- Input from outside of FPGA to the FPGA pin.
- A delay element for the input, having an output for providing a delay to the input signal.
- A multiplexer is providing a delayed input signal.
- A register/latch is providing a register/latch output signal.
- A set/reset line for providing a set/reset signal
- A decoder for providing the set signal or the reset signal responsive to the set/reset signal.
- An amplifier has an output for providing an amplified signal to a related resource in the FPGA.

Modern FPGA Architecture



Morden-day FPGA Architechture

1 Clocking Architecture

High-Speed Transceivers 2

3 FPGA DSP

FPGA Timing 4

FPGA Advantages and Today's Applications

Advantages

- Real time applications
- Programmability
- Performance
- Cost
- Prototyping
- Fast tme to market
- etc

Application

1. Video & Image
2. Telcom & Datacom
3. Aerospace & Defense
4. Server & Cloud
5. Medical & Scientific applications

Applications

Video & Image: FPGAs are utilized in digital signal processing applications and signal processing systems because they feature a huge internal memory and a lot of multipliers.

Telcom & Datacom: Applications for autonomous driving are made possible by the usage of FPGA in automotive and transportation. for a decrease in overall energy costs, an increase in power and communication systems, an increase in efficiency, a strengthening of security systems, and a decrease in overall cost.

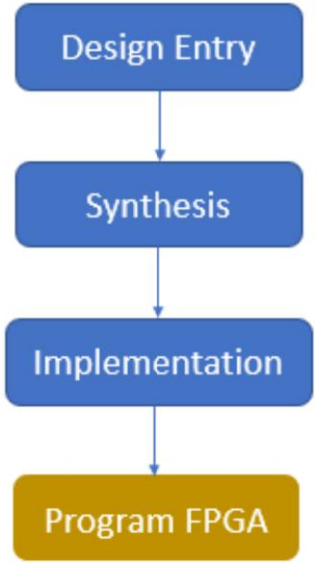
Applications

Server & Cloud: FPGAs are used to speed up applications involving artificial neural networks or machine learning as well as hardware and algorithms.

Medical & Scientific applications: They are also being used in a variety of scientific, medical, and consumer gadgets, including bioinformatics, speech recognition technologies, security, and wireless and wired communications systems.

FPGA Design Process

Design Flow



- Design entry
- Logic Synthesis
- Implementation
- Simulation + Validation

Types of FPGA

Low End FPGAs

Systems that require low power consumption, high logic density, and complexity on the chip are best served by low-end FPGAs.

Mid Range FPGAs

Mid-range FPGAs are a marriage of performance and price and are often regarded as the best option because they strike the right balance between cost and density, complexity, and consumption per chip without sacrificing either too much.

High End FPGAs

High end FPGAs may be more expensive and use more power than entry-level FPGAs, but they also provide the best capabilities with the most logic complexity and density as well as the best overall performance.

FPGA Design Services Companies

BitSim

Sweden

BitSim is a design house focusing on Imaging and Data Acquisition, the only certified Xilinx partner in the Nordic countries.

RT-RK

Serbia

RT-RK is providing high-quality HW & SW development services in the automotive, industrial and consumer electronics domain.

Micro Technology Services

USA

Micro Technology Services, Inc. is a professional design service company dedicated to our customers for 32 years.

Orthogone Technologies

Canada

Orthogone offers highly specialized engineering services focused on the development of innovative electronic products requiring an in-depth knowledge of embedded systems, FPGAs and (SOC).

Fidus Systems

Canada

Specializing in electronic product development - hardware, software, FPGA, verification, wireless, mechanical and signal integrity. 20+ years, 400+ customers, 3000+ projects.

Critical Link

USA

Critical Link develops embedded solutions – System on Modules (SOMs) and imaging platforms – for a wide range of industrial applications.

Conclusion

In the end, FPGA delivers powerful and configurable computing solutions at a somewhat cheaper cost and with a smaller carbon footprint than some of the other technology in its class that is no longer capable of offering the best answers to contemporary computing issues.

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