



# FPGA based System Design

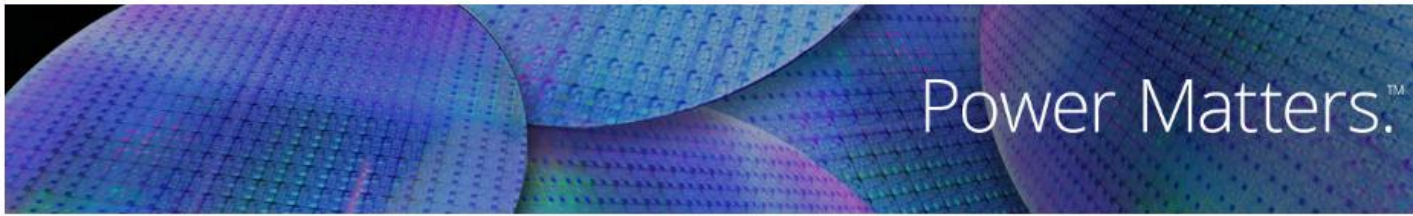
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- Role of FPGA
- FPGA in Embedded design
- FPGA market share
- What you will learn?
- Course Outcomes
- Evaluation Pattern



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Demonstrations at RISC-V Summit Dec. 4-5 to Show Size, Power and Performance Benefits of Integrating PolarFire SoC's Hard CPU Subsystem with Programmable Logic  
 Photos (2)



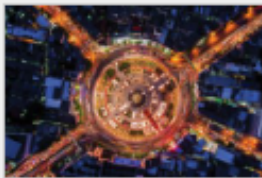
NOV 28, 2018  
**Rep. McSally Visits Microchip Executives to Discuss Semiconductor Supply Chain Resilience in the Amid Defense Industrial Base Report Findings**  
Microchip Updates Member of House Armed Services Committee on How Its Initiatives Align With Recommendations in New Report



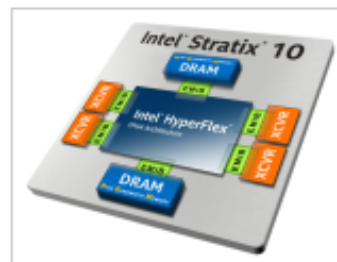
## Intel integrates FPGA and ARM CPU

Intel says it has begun shipping its Intel Stratix 10 SX FPGA –the only high-end FPGA family with an integrated quad-core ARM Cortex-A53. It is manufactured on Intel's 14nm finfet process.

### RECOMMENDED ARTICLES



NGMN presses 5G strategy on Juncker



With densities greater than 1 million logic elements (MLE), Intel Stratix 10 SX FPGAs provide the flexibility and low latency benefit of integrating an ARM processor with

a high-performance, high-density FPGA needed to tackle the design challenges of next-generation, high-performance systems.

arm

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## Arm expands design possibilities with free Cortex-M processors for Xilinx FPGAs

October 01, 2018

By Phil Burr, director, portfolio product management, Arm

### News Highlights:

- Arm collaboration with Xilinx brings together the benefits of the industry's most robust and mature embedded ecosystem with the flexibility of Xilinx FPGAs





**BUSINESS**

# Xilinx will use Arm cores in FPGA

DEAN TAKAHASHI @DEANTAK OCTOBER 1, 2018 10:00 AM



Above: Arm and Xilinx are teaming up.

## Emergent Tech

### Free for every Reg reader – and everyone else, too: Arm Cortex-M CPUs for Xilinx FPGAs

Like the blueprints we gave away last time... but... better

By Chris Williams, Editor in Chief 1 Oct 2018 at 20:07

15 SHARE



Chip shop ... An Arm DesignStart-compatible Xilinx FPGA board

XDF If you've ever wanted to embed cheap-and-cheerful Arm Cortex CPU cores into your Xilinx FPGA designs, well, now's your chance.

The processor designer is making its 32-bit microcontroller-grade Cor

## FREE ARM CORES FOR XILINX FPGAS

by Jenny List

28 Comments

8\*

October 2, 2018



5 billion chips to date, and now... mable gate arrays, or FPGAs.

ned with a hardware design after



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By Richard Wils

Comment

## Intel based FPGAs to better machine learning and AI applications

27 June 2017

Intel plans to use its FPGA-based

The latest 'buzz phrases' to emerge into general use are 'machine learning' and artificial intelligence, or AI. Both techniques have wide application, so it's no surprise to find technology companies all of types pursuing the opportunities.

Intel is no exception, addressing the topics through acquisitions and internal development in a move to create 'end to end' solutions. Bill Jenkins, senior AI product specialist with Intel's Programmable Systems Group (PSG, formerly Altera) said: "Intel has formed an AI group, while PSG has a focus on machine learning, so there's an AI effort across the company; it's a big topic."

Jenkins said it's all about extracting patterns from data and then deciding what to do with the information. "It's data analytics and perceptual issues; for example, do I understand what something means? How is a word perceived? How is an object used? That's AI."

Whilst both terms date back to the 1950s, it is only recently that the level of computing power available has allowed researchers and developers to achieve significant results. "People have been working in this field for some time," said Jenkins. "But in the 1990s, we didn't have enough compute power to solve the problems."

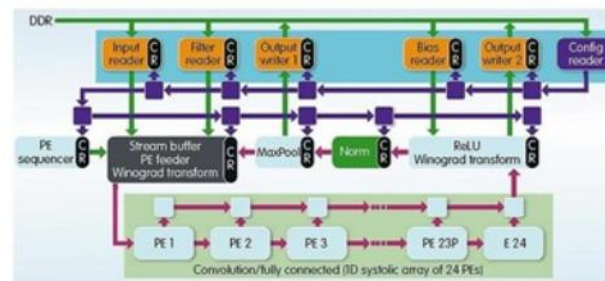


Figure 1: Using OpenCL, developers can think about problems rather than architectures

### RECOMMENDED ARTICLES



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# Boeing First to Use Embedded FPGAs

4 October 2018 · George Leopold



14nm FinFET FPGAs to be manufactured by  
GlobalFoundries in New York

Aerospace giant Boeing is the first customer to tap embedded FPGA cores based on chip maker Flex Logix Technologies' 14-nm design being manufactured at a U.S. fab.

Department of Electrical & Electronics Engineering, Amrita Vishwa Vidyapeetham, Coimbatore.

AI



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By Caroline

## FPGA output

Xilinx Development convolution now. The CEO Roger

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Microsemi and RISC-V based

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Accelerate exploration techniques



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This article was posted on 02/14/2018



## 2018: the year of the embedded FPGA

*By Majeed Ahmad, contributing editor*

What's next in the FPGA technology realm? If the flurry of design announcements in technology media tells you anything, it's that the time for the embedded FPGA or eFPGA has finally come. Achronix Semiconductor calls 2017 the breakout growth year for the eFPGA technology.

The San Jose, California-based chip firm claims that that's when its revenue grew 700% year-over-year and that its headcount increased by 30% in 2017. Other semiconductor outfits pushing the eFPGA initiative include Flex Logix, Menta, and QuickLogic.

The FPGA lite technology is promising to combine the ASIC design efficiency with FPGA's flexibility for incorporating hardware accelerators on a single chip. And that allows engineers to change the configuration or firmware of the chip later on to meet the changing needs of the design.



# Global Embedded System Market is Estimated to Grow at a CAGR of 6.4% and Reach USD 233.13 Billion by 2021: Transparency Market Research

NEWS PROVIDED BY

[Transparency Market Research](#) →

Aug 26, 2015, 08:30 ET

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ALBANY, New York, August 26, 2015 /PRNewswire/ --

According to a new market report published by Transparency Market Research **Embedded System Market - Global Industry Analysis, Size, Share, Growth, Trends and Forecast, 2015 - 2021** was valued at USD 152.94 billion in 2014 and is estimated to grow at a CAGR of 6.4% and reach USD 233.13 billion by 2021.



# Embedded FPGA Market Expected to Reach \$8,981 Million, Globally by 2024



NEWS PROVIDED BY  
**Allied Market Research** →  
Jun 14, 2018, 07:00 ET

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PORTLAND, Oregon and PUNE, India, June 14, 2018 /PRNewswire/ --

According to a new report by Allied Market Research, titled, [Global Embedded FPGA Market by Technology and Application: Global Opportunities Analysis and Industry Forecast, 2018-2024](#), the global embedded FPGA market was valued at \$3,026 million in 2017, and is projected to reach at \$8,981 million by 2024, registering a CAGR of 16.5% from 2018 to 2024.

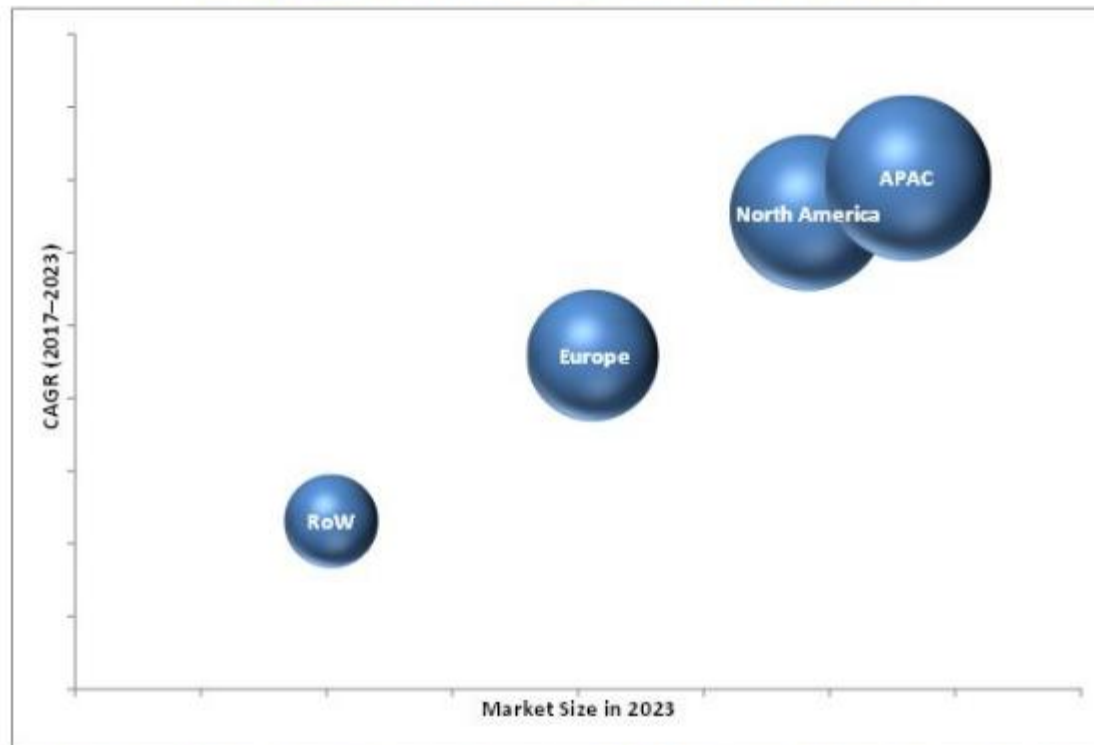
### Industry Trends

Field Programmable Gate Array (FPGA) Market size was valued at USD 5.27 billion in 2014 and is expected to grow at a CAGR of 8.4% from 2015 to 2022. Increased demand customizable ICs coupled with rising demand from application areas is expected to propel the industry growth over the forecast period.

Asia Pacific FPGA market size by application, 2012-2022 (USD Million)



FPGA Market, by Region, 2023 (USD Billion)



Source: Investor Relation Presentations, Annual Reports, Expert Interviews, and MarketsandMarkets Analysis





# 18ES624 FPGA based System Design

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- What you will learn?
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- Evaluation Pattern



HDL – Role of HDL - HDL for Design Synthesis - Design Flow – Programmable logic: Simple PLDs, CPLDs ,FPGA HDL - A Simple Design – HDL elements - Data flow – behavioural – structural modeling - Creating Combinational and Synchronous Logic - Designing FIFO - Test Benches - State Machine Designs - Design Examples - Memory Controller - Mealy State Machines - Design Considerations - Hierarchy in Large Designs - Functions and Procedures – Subprograms.

General principles of circuit synthesis - Synthesis and Design Implementation - Synthesis and Fitting CPLDs, FPGAs- Resource Sharing - Creating Test Benches – Implementation technology – PLD's, Custom Chips, Standard Cell and Gate arrays – FPGA Architectures – SRAM based FPGAs – Permanently programmed FPGAs – Circuit design of FPGA fabrics – Architecture of FPGA fabrics – Logic Implementation of FPGAs - Physical design for FPGAs.

### Suggested Readings



### Main Text

1. M.Morris Mano, Michael D.Ciletti, "Digital Design: With an Introduction to VerilogHDL", Pearson, Fifth Ed, 2007
2. Samir Palnitkar, "Verilog HDL: a guide to digital design and synthesis", Prentice Hall, Second Edition, 2003
3. Wayne Wolf, "FPGA based System Design", Prentice Hall, 2004





# Course Outcomes

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## **Course Outcomes (COs):**

CO1: Realization of combinational logic circuits in circuit level and using PLDs

CO2: Design combinational logic circuits using HDL

CO3: Design sequential logic circuits using HDL

CO4: Understand the design styles in different FPGA architectures

CO5: Synthesize digital circuits in FPGAs





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## Evaluation

Method of evaluation is by Continuous Assessment and an End-of-Semester examination.

### **Continuous Assessment - 70%**

Periodical Test I - 15%

Periodical Test II - 15%

Quiz/Assignment - 10%

Laboratory - 10%

Mini Project - 20%

### **End-of-Semester Examination - 30%**

Course Webpage: <http://eeeforum.weebly.com>

