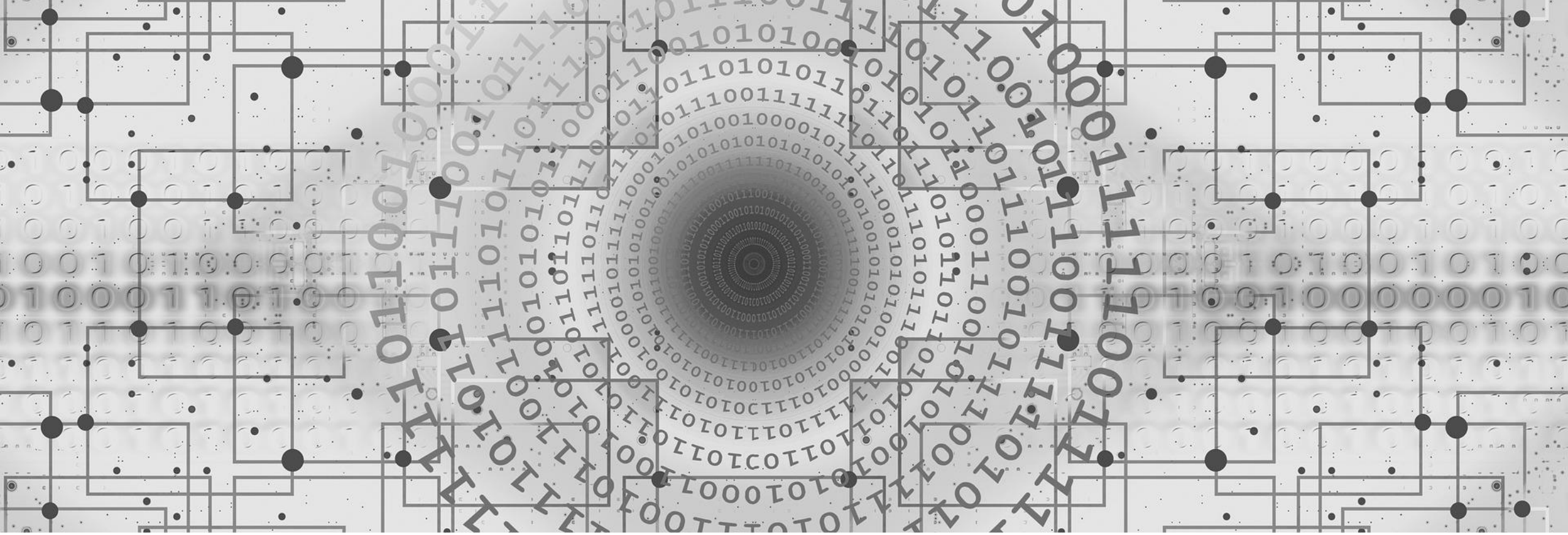

Applications of FPGA

ECE-111 Advanced Digital Design Project

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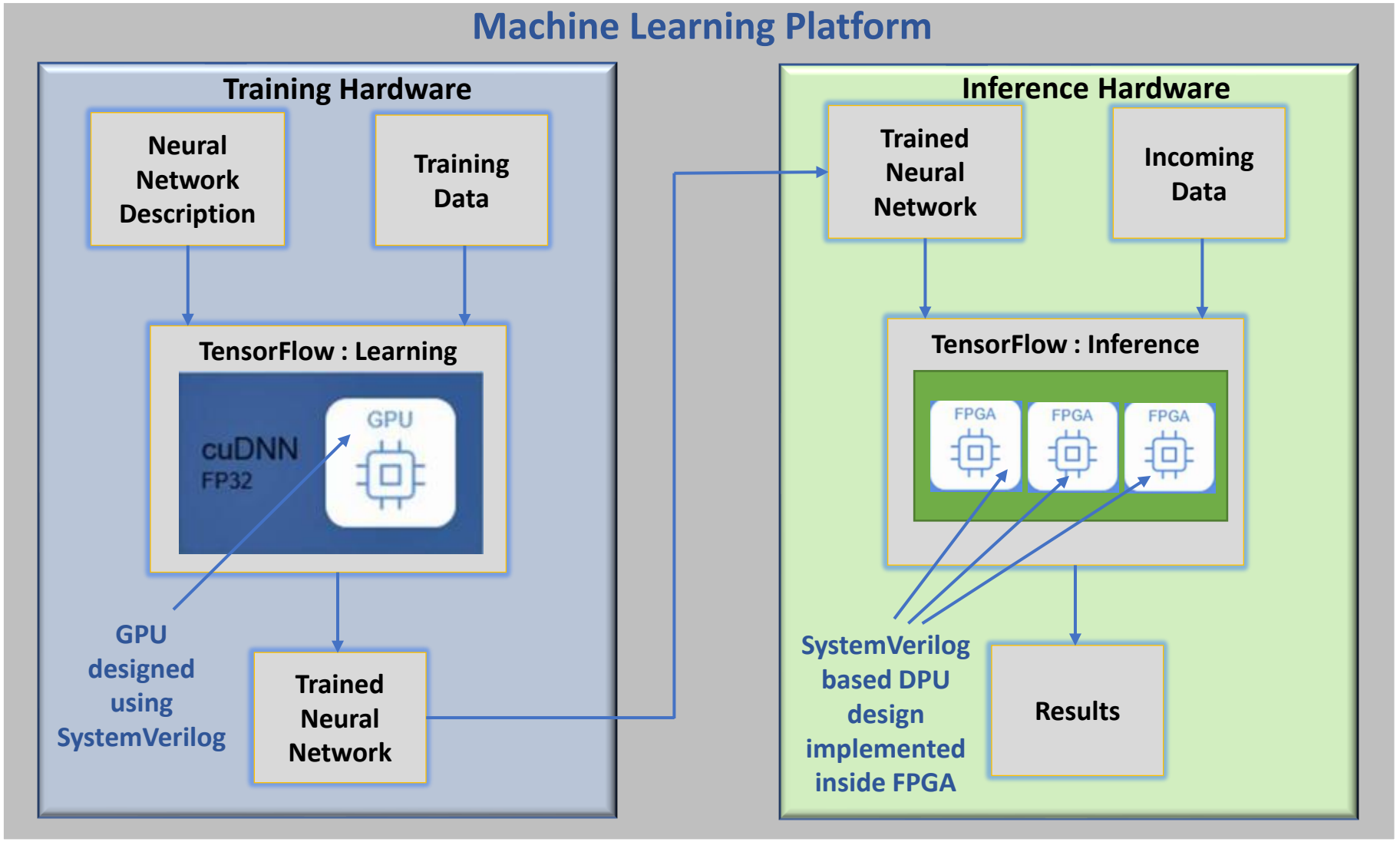
Winter 2022

UC San Diego
JACOBS SCHOOL OF ENGINEERING
Electrical and Computer Engineering

Application of FPGA's : Machine Learning Platform

- **ASIC** hardware (**GPU** based) for Neural Network Training
- **FPGA** based hardware accelerator for Inference (**DPU** : Data Processing Unit)
- Logic design inside **FPGA** and **GPU** design implemented using SystemVerilog

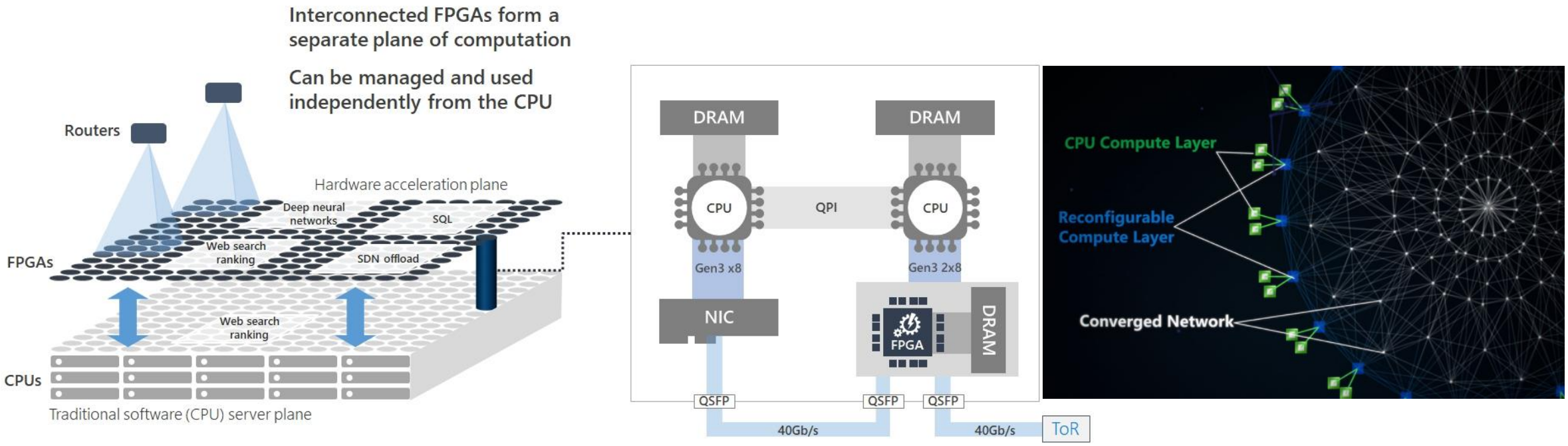


Application of FPGA's : Automotive

- **Due to its high configurability FPGA based designs in modern car's is enabling auto makers to keep up with the latest consumer and safety trends to enhance In-Vehicle-Experience (IVE). Enables future proofing of hardware !**
- **Intel Altera FPGA's has enabled advanced systems with unique features in IVE and Infotainment :**
  - **Visual data** (more displays, higher resolutions, unique surfaces, projection-based systems)
  - **Safety features** such as gesture, speech and voice recognition, Driver Monitoring System, Lane Departure Warning and Blind Spot Detection
  - **Consumer electronics connectivity and Graphics IP for Infotainment** such as USB, Bluetooth, WIFI, Video & Display connectivity

Application of FPGA's : Cloud Computing

- **Microsoft Catapult initiative has transformed cloud computing by augmenting CPUs with an interconnected and configurable compute layer composed of FPGA**
  - FPGA based hardware accelerator is utilized to give CPU a boost and handle critical workloads and big data
  - Network traffic is routed through the FPGA, which can perform line-rate computation on even high-bandwidth network flows

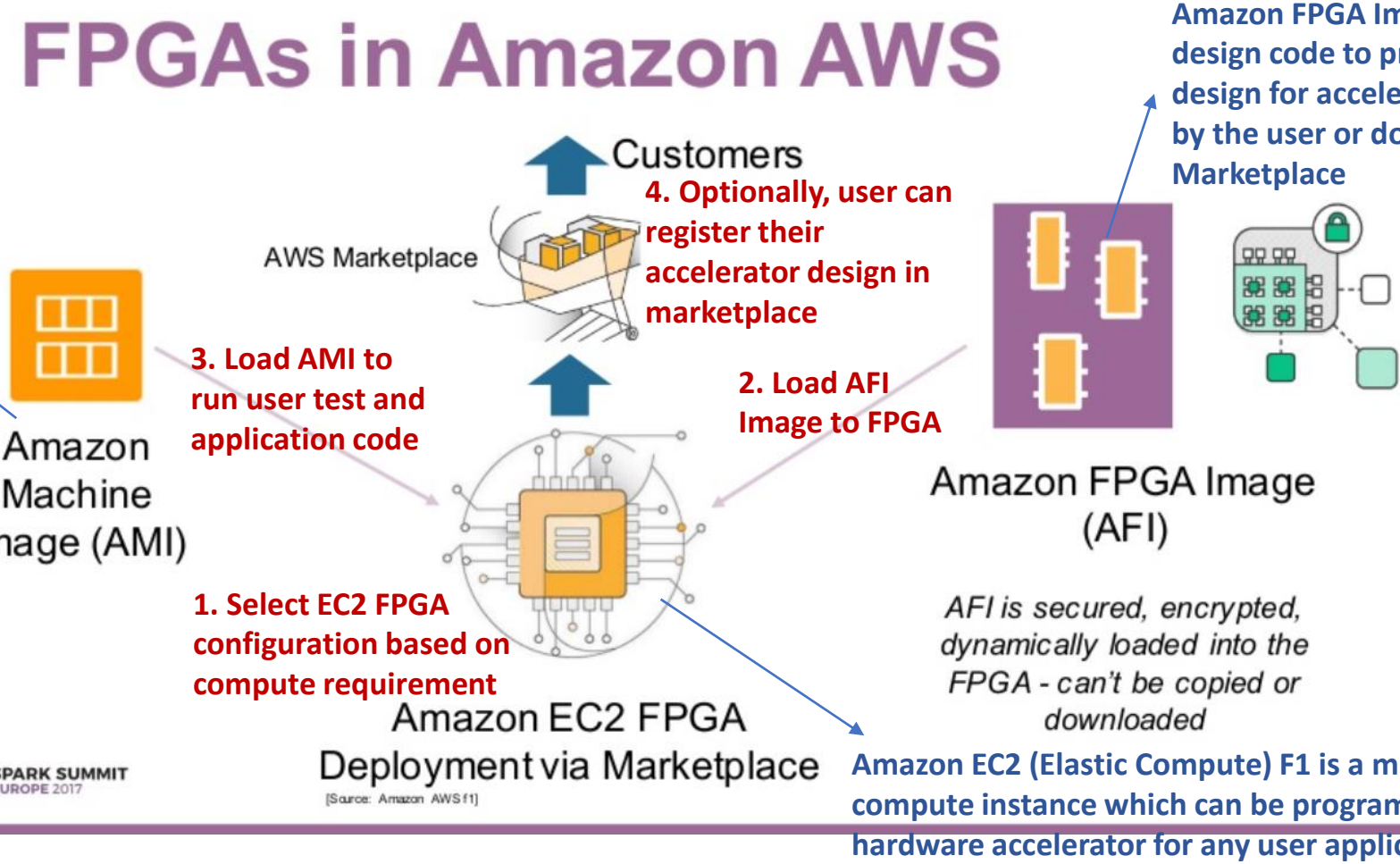


[Credit: Microsoft, MICRO'16]

All digital design blocks such as CPU, DRAM Controller, Interconnects, NIC are all designed using HDL Language such as SystemVerilog !

Application of FPGA's : Hardware Accelerator Development Over Cloud

- Amazon Web Services (AWS) cloud provides configurable FPGA based hardware accelerators with full FPGA tool development, simulation and debugging kit for application development and/or testing user accelerator (HDL) designs

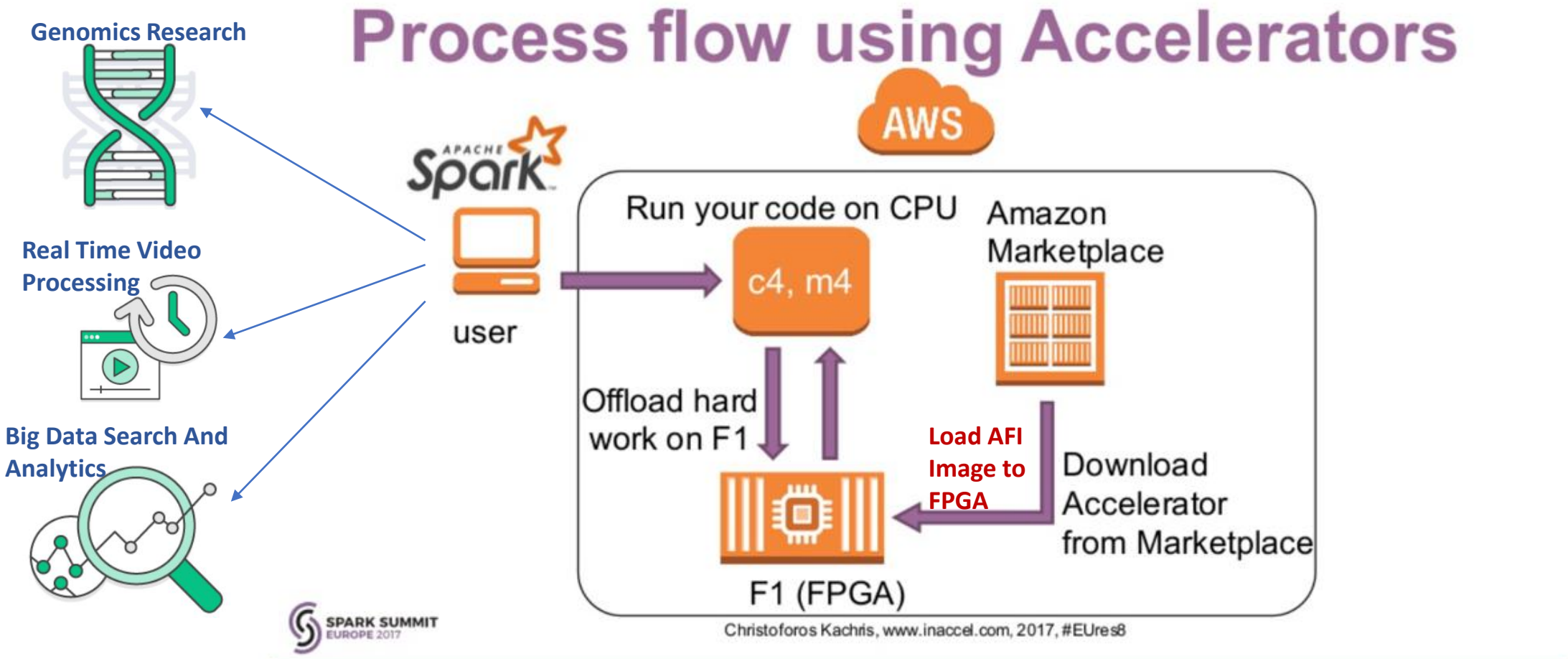


To learn more about Amazon cloud-based hardware accelerators and process, click on the link below :
https://aws.amazon.com/education/F1-instances-for-educators/

Application of FPGA's : High Performance Computing Over Cloud

- **Amazon Web Services For :**
  - High Performance Computing Applications to solve complex science, engineering, and business problems that require high bandwidth, enhanced networking, and very high compute capabilities such as :

    Genomics Research, Real Time Video Processing, Big Data Search and Analytics



Applications of FPGA's and Use of System Verilog

- With more and more FPGA based Clouds Platforms are emerging, SystemVerilog usage is further increasing beyond ASIC chip designs