ADVANCES IN SYSTEM ARCHITECTURES –

TECHNOLOGIES AND DEVICES ENABLING HETEROGENEOUS COMPUTING

ADAM SMITH – ALPHA DATA

TECHNOLOGIES AND DEVICES ENABLING HETEROGENEOUS COMPUTING

Combining multiple processing elements to form hybrid high performance computing systems.

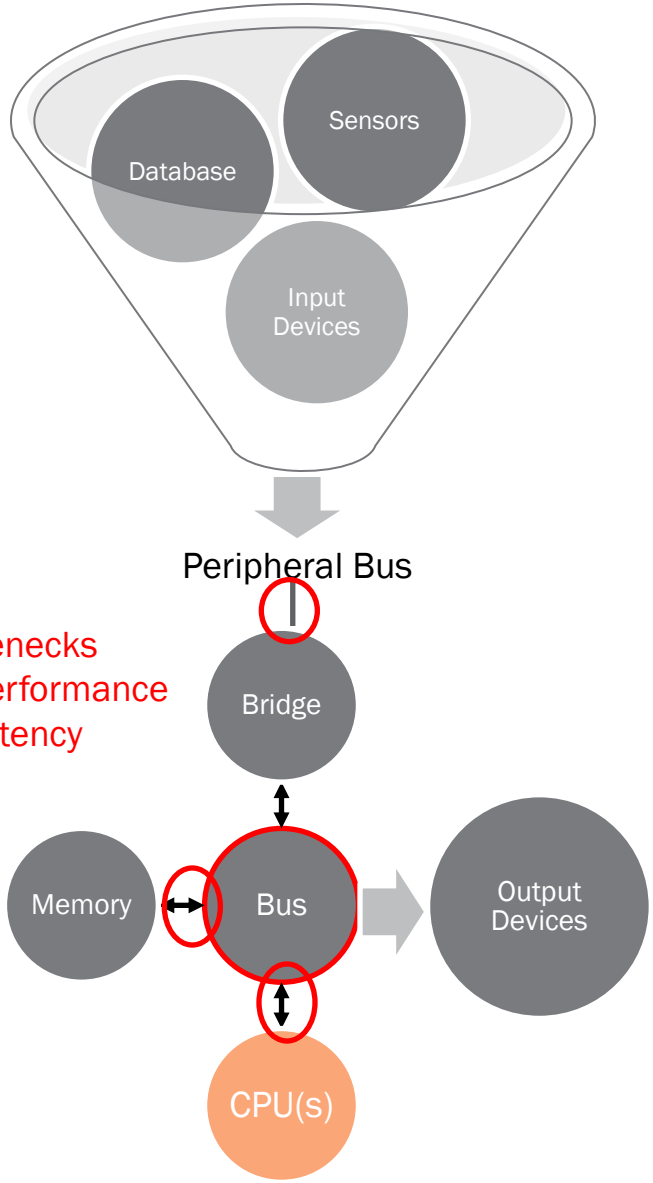
- CPU,FPGA,GPU,DSP
- SoC Devices (Zynq, Cyclone / Arria V SoC, SmartFusion2)

Create hybrid systems to benefit from the best characteristics of each:

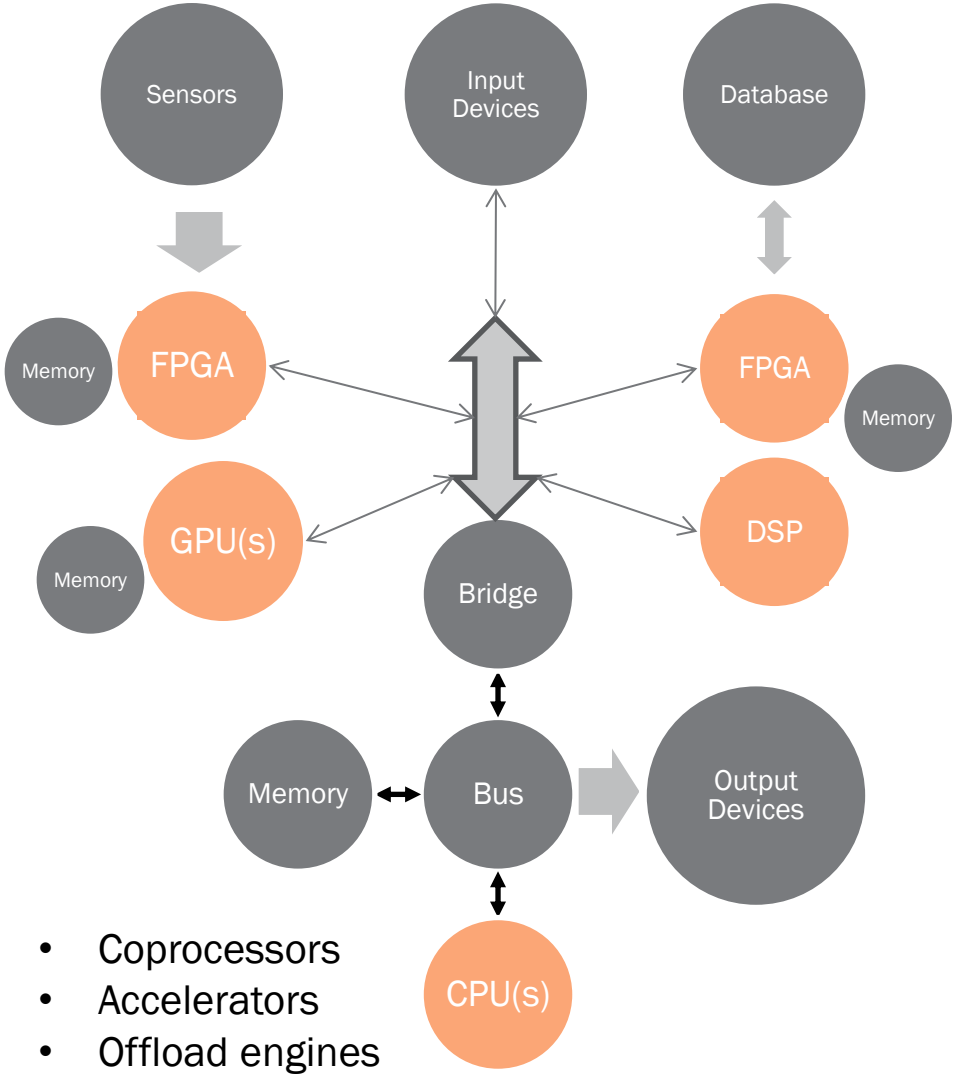
- Low latency
- Power efficiency
- Performance-per-dollar
- Longer product life
- Customization
- Efficient use of diverse processors

Applications

SIMPLE DATAFLOW
(CENTRAL PROCESSOR)



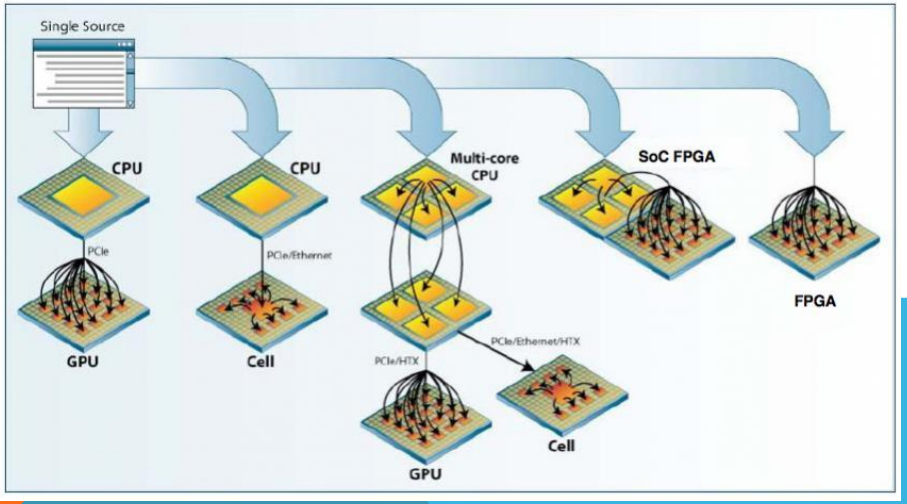
HIGH PERFORMANCE DATAFLOW
(HETEROGENEOUS PROCESSING)

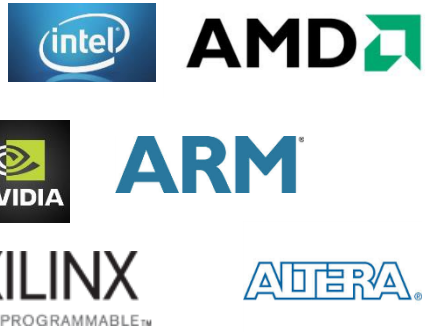


- Coprocessors
- Accelerators
- Offload engines
- Multiprocessors

OpenCL = Portable

- The free and open standard for parallel programming of heterogeneous systems
- Enables programming of diverse compute resources
  - CPU, GPU, DSP, FPGA – and hardware blocks
  - OpenCL is a set of APIs that abstract HPC-related tasks from the underlying hardware





FPGAs IN HIGH PERFORMANCE COMPUTING

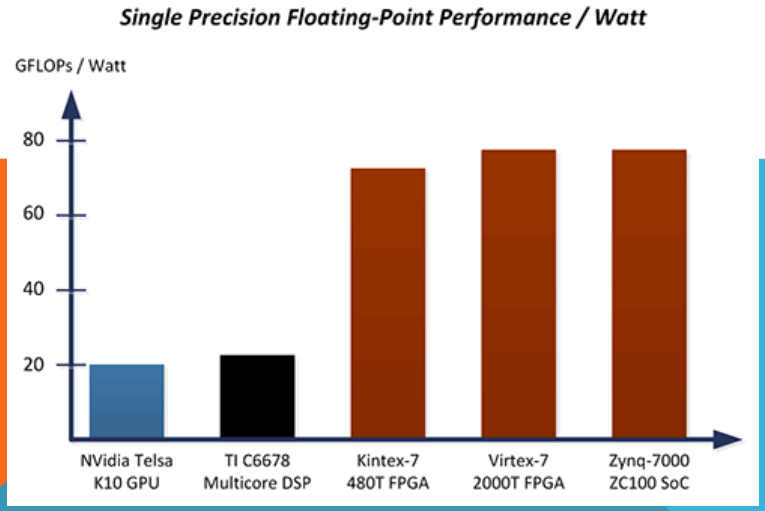
+ Lowest latency – connect sensors, input devices, data storage, etc. directly to the processing element.

+ Longest Lifecycle – 10+ years is typical, compared to 3-4 years for CPUs

+ Best power efficiency

Becoming more mainstream in HPC due to higher level programming models (OpenCL, Vivado High Level Synthesis, MatLab integration, etc.)

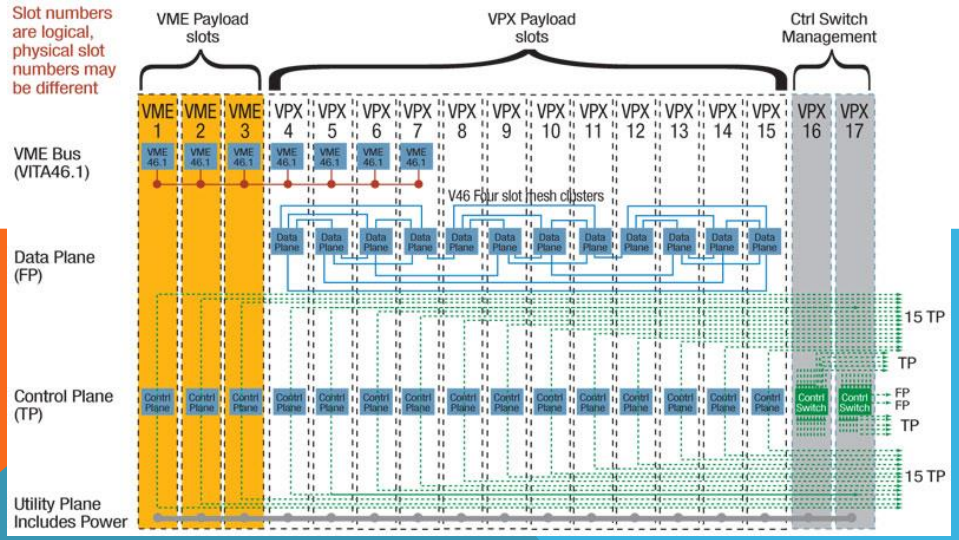
- Vivado HLS - First fully supported commercial deployment of high-level synthesis (C++ to HDL) by an FPGA vendor



XILINX
ALL PROGRAMMABLE™

VPX – Highly Customizable System Interconnect

- Very high performance board to board interconnect
  - Switched Serial Fabric
- In applications that don't have much sequential workload– the majority of the data processing is done in FPGAs, GPUs, or DSPs, leaving the CPU for simple command / control / monitoring functions.



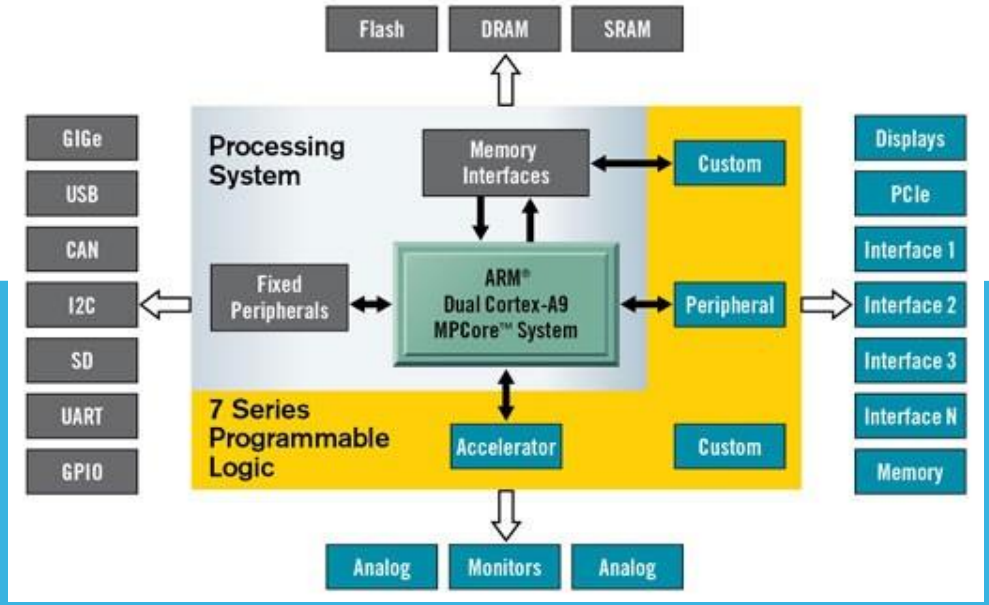
OpenVPX™

SYSTEM ON A CHIP DEVICES

FPGA + CPU devices have been tried before… but the latest generation chips finally offer sufficient performance to displace the central processor in embedded system architectures.

Overcoming fixed-performance limitations without introducing new levels of hierarchy or complexity.

Could this be the beginning of the end for SBCs in some applications?



CONCLUSION

The future of embedded computing is hybrid processing architectures.

- Software / Programming models to span different processors
- Hardware systems with diverse processing elements

Any Questions?