SOC Design

Week 11: Microblaze I

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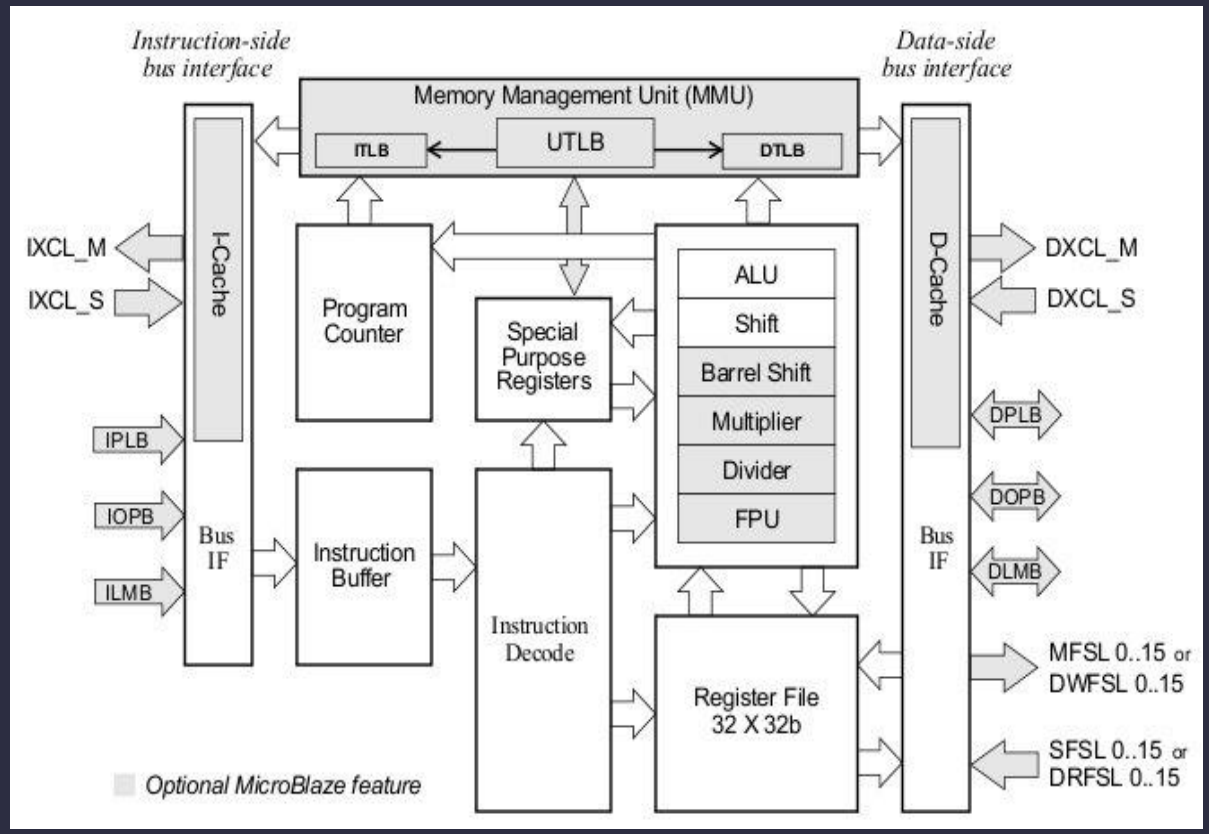
Microblaze

The MicroBlaze CPU is a family of drop-in, modifiable preset 32-bit/64-bit RISC microprocessor configurations.



Microblaze

The MicroBlaze is a soft Processor

Hard Core Processors - 100's of MHz up to 1GHz+ of speed

•Can achieve much faster processing speeds since they are optimized and not limited by fabric speed
•Fixed and cannot be modified (though it can take advantage of custom logic in FPGA fabric for processing

Soft Core Processors - 250MHz and less (usually less than 200MHz)
•Can be easily modified and tuned to specific requirements, more features, custom instructions, etc.
•Multiple cores can be used (at the cost of resources)
•Limited by the speed of the fabric.

Microblaze

The MicroBlaze processor meets the requirements of many diverse applications including Industrial, Medical, Automotive, Consumer, and Communications markets.

To help you quickly deploy your application, the MicroBlaze processor includes three preset configurations analogous to familiar processor classes.

- Microcontroller: Suitable for running baremetal code
- Real-Time Processor: Deterministic real-time processing on an RTOS
- Application Processor: Embedded Linux capable

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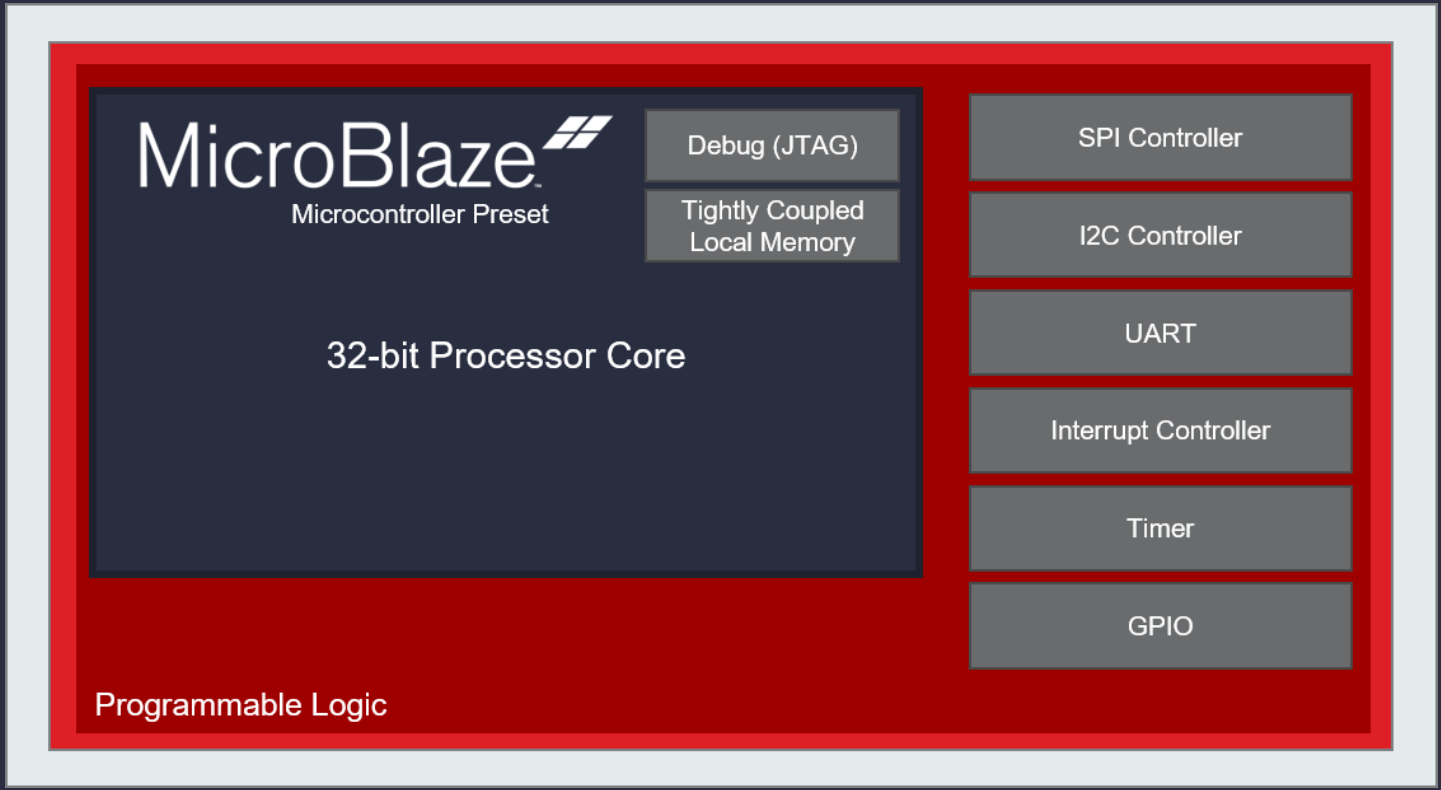
Microblaze

Key Capabilities

- 32-bit instruction set and general purpose registers
- 32-bit address bus, extensible to 64 bits
- Optional floating point unit
- Sleep, Hibernate, and Suspend Mode/Instructions

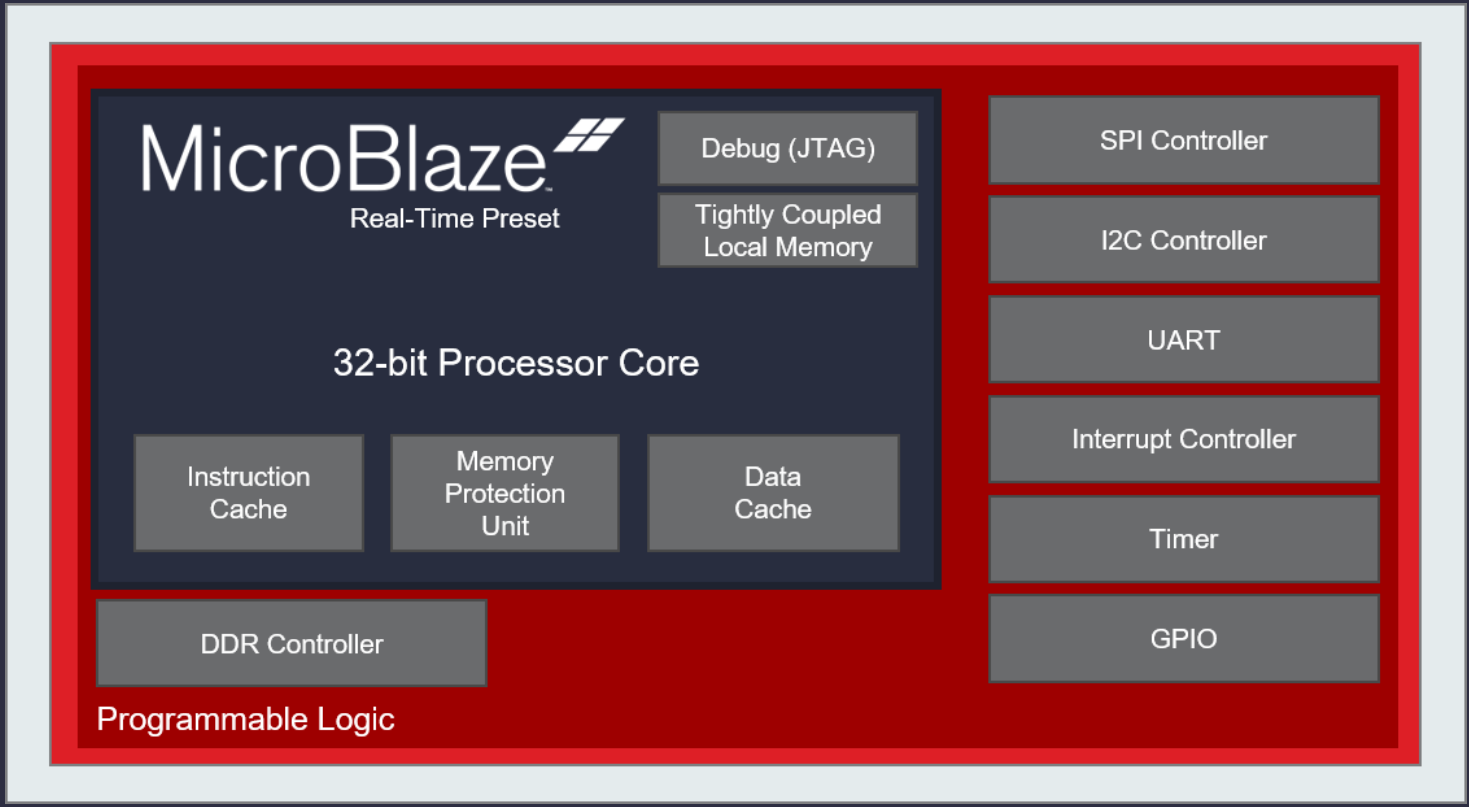
Microblaze



Microcontroller Preset (up to 200DMIPs)

- 32-bit Processor Core
- JTAG Debug Interface
- Tightly Coupled Local Memory
- SPI controller
- I2C Controller
- UART
- Interrupt Controller
- Timer
- GPIO

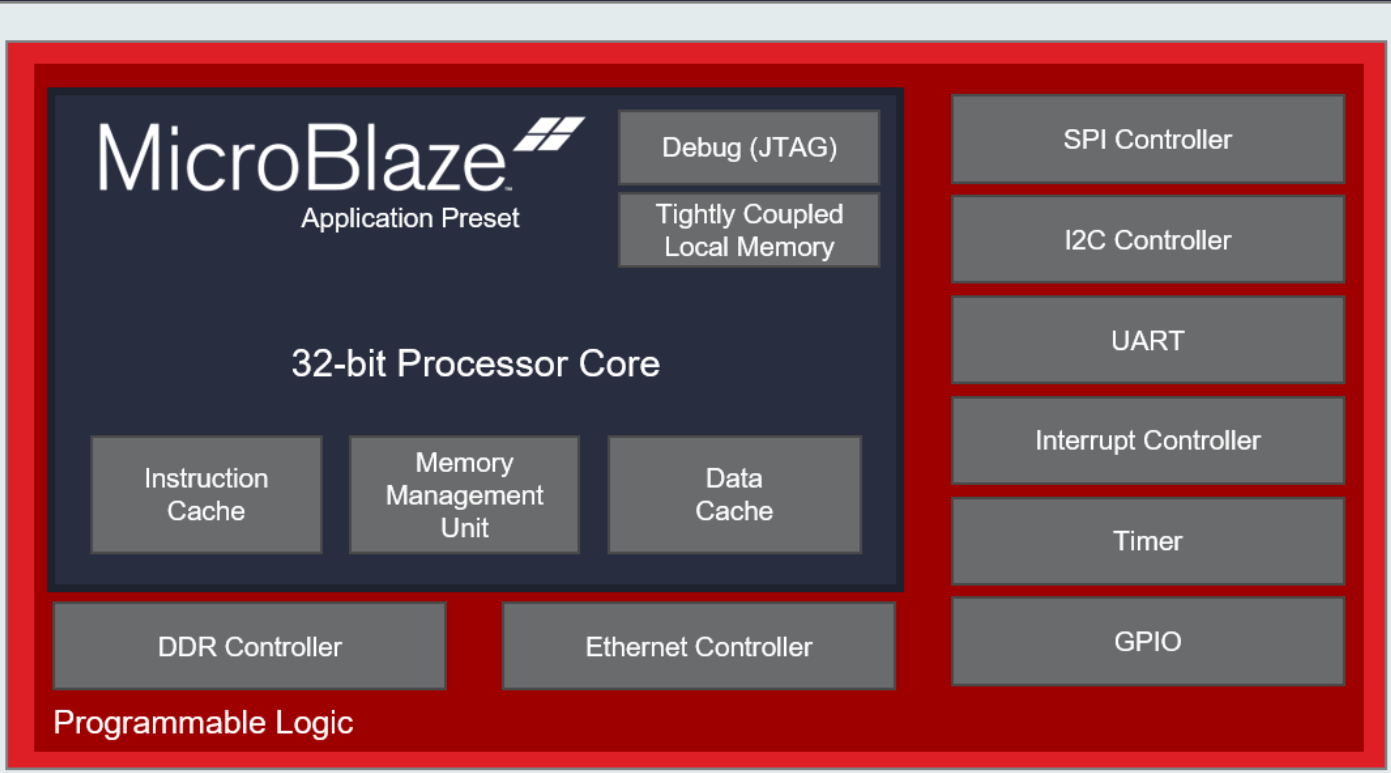
Microblaze



- **Real-Time Processor Preset** (up to 200DMIPs)All Microcontroller Preset blocks

- Instruction Cache
- Memory Protection Unit
- Data Cache
- DDR Memory Controller

Microblaze



Application Processor Preset (up to 180DMIPs)All Real-Time Processor Preset blocks

- Memory Management Unit
- Ethernet Controller

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MicroBlaze Performance Metrics

Device	Microcontroller (1.04 DMIPs/MHz)		Real-Time Processor (1.31 DMIPs/MHz)		Applications Processor (1.31 DMIPs/MHz)	
	Fmax	DMIPS	Fmax	DMIPS	Fmax	DMIPS
Cost-Optimized Portfolio Devices						
Spartan-7 (-2)	178	185	155	203	120	157
Artix-7 (-3)	204	212	172	225	146	191
Zynq 7000S (-2)	187	194	156	204	129	169
Zynq-7000 (-3)	212	220	171	224	141	185

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MicroBlaze Performance Metrics

FPGAs, 3D ICs, and MPSoCs						
Kintex-7 (-3)	298	310	228	299	204	267
Virtex-7 (-3)	300	312	238	312	208	272
Kintex UltraScale (-3)	393	409	280	367	242	317
Virtex UltraScale (-3)	384	399	283	371	245	321
Kintex UltraScale+ (-3)	518	539	384	503	345	452
Virtex UltraScale+ (-3)	505	525	396	519	327	428
Zynq UltraScale+ MPSoC (-3)	493	513	379	496	329	431

Microblaze

MIPS Comparison:

Processor / System	Dhrystone MIPS or MIPS, and frequency	Year
AMD Ryzen Threadripper 3990X	2,356,230 MIPS at 4.35 GHz	2020
AMD Ryzen 9 3950X	749,070 MIPS at 4.6 GHz	2019
Intel Core i9-9900K	412,090 MIPS at 4.7 GHz	2018
Intel Core i7 6950X	320,440 MIPS at 3.5 GHz	2016
AMD Ryzen 7 1800X	304,510 MIPS at 3.7 GHz	2017
Intel Core i7 5960X	298,190 MIPS at 3.5 GHz	2014
Intel Core i7-8086K	221,720 MIPS at 5.0 GHz	2018
Intel Core i7-3960X	176,170 MIPS at 3.3 GHz	2011
Intel Core i7 Extreme Edition 980X (6-core)	147,600 MIPS at 3.33 GHz	2010
Intel Core i7 4770K	133,740 MIPS at 3.9 GHz	2013
Intel Core i7 2600K	117,160 MIPS at 3.4 GHz	2011
AMD FX-9590	115,625 MIPS at 5.0 GHz	2012
Intel Core i7 3770K	106,924 MIPS at 3.9 GHz	2012
Arm Cortex A9	2000 MIPS	2012