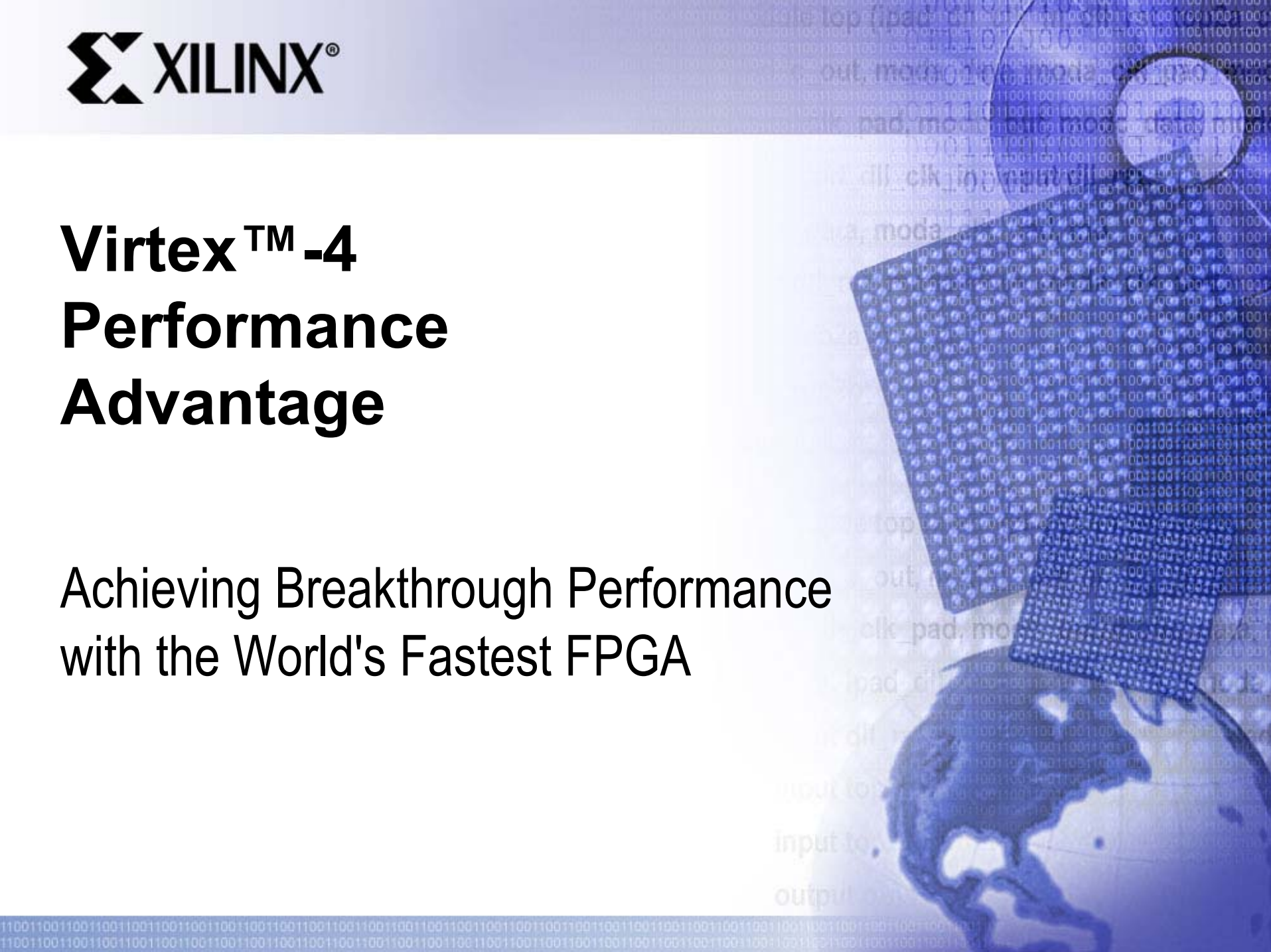
Virtex™-4 Performance Advantage

Achieving Breakthrough Performance with the World's Fastest FPGA

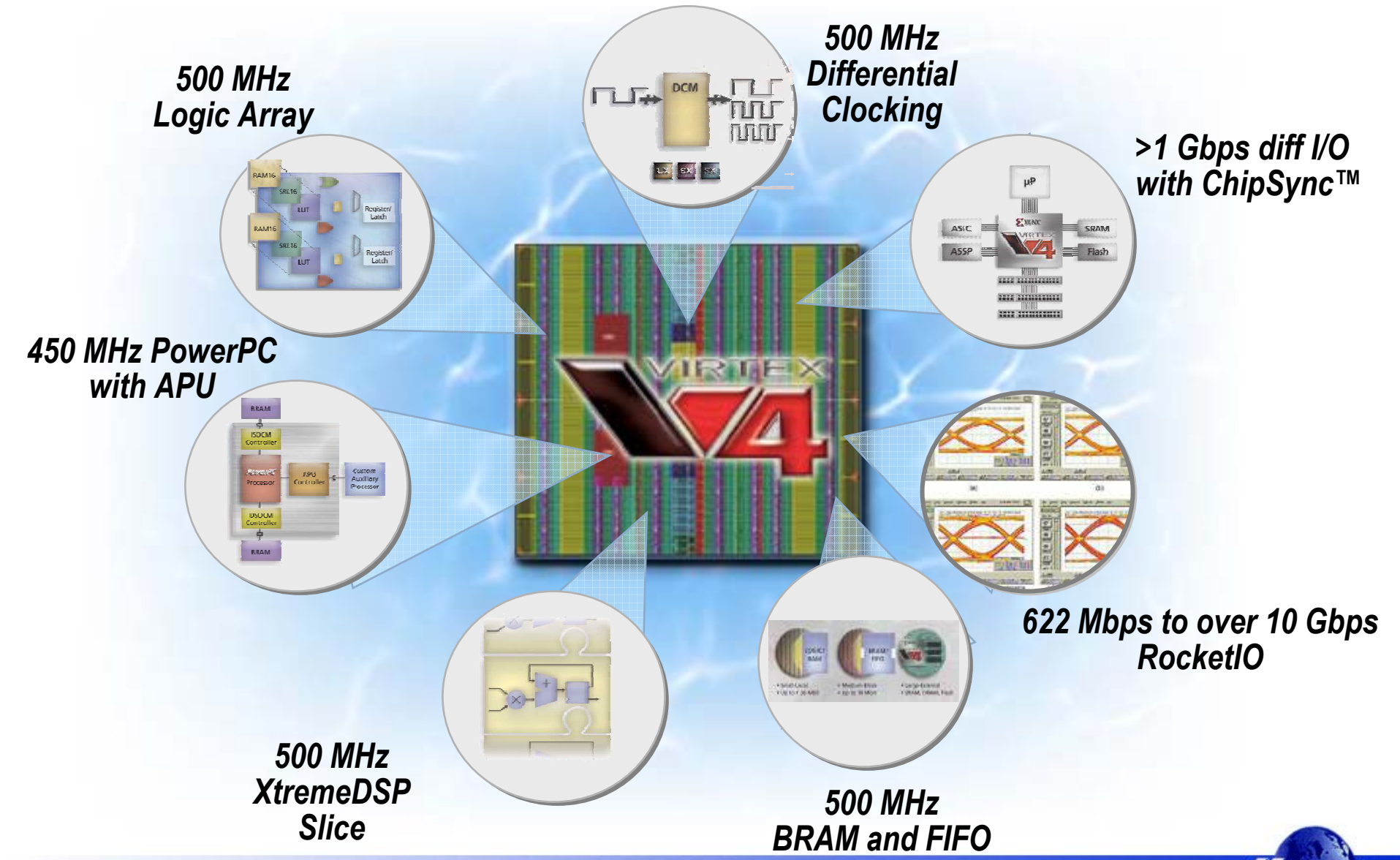


500 MHz Virtex-4…

1. 90 nm ***technology*** is the foundation
   - More transistors, faster speed and lower cost
2. Clever ***circuit design*** builds on that foundation
   - Smaller size, lower power, and higher performance
3. ***Architectural innovation***, novel features
   - Hard-coded IP:
     - PowerPC®, BRAM-FIFO, DSP-MAC
   - Source-synchronous I/O with delay-line on every pin,
   - Dedicated Multi-Gigabit Transceivers up to 10 Gbps
4. Continuously improving design tools, easier to use

…the fastest FPGA family in the world

Architectural Innovation



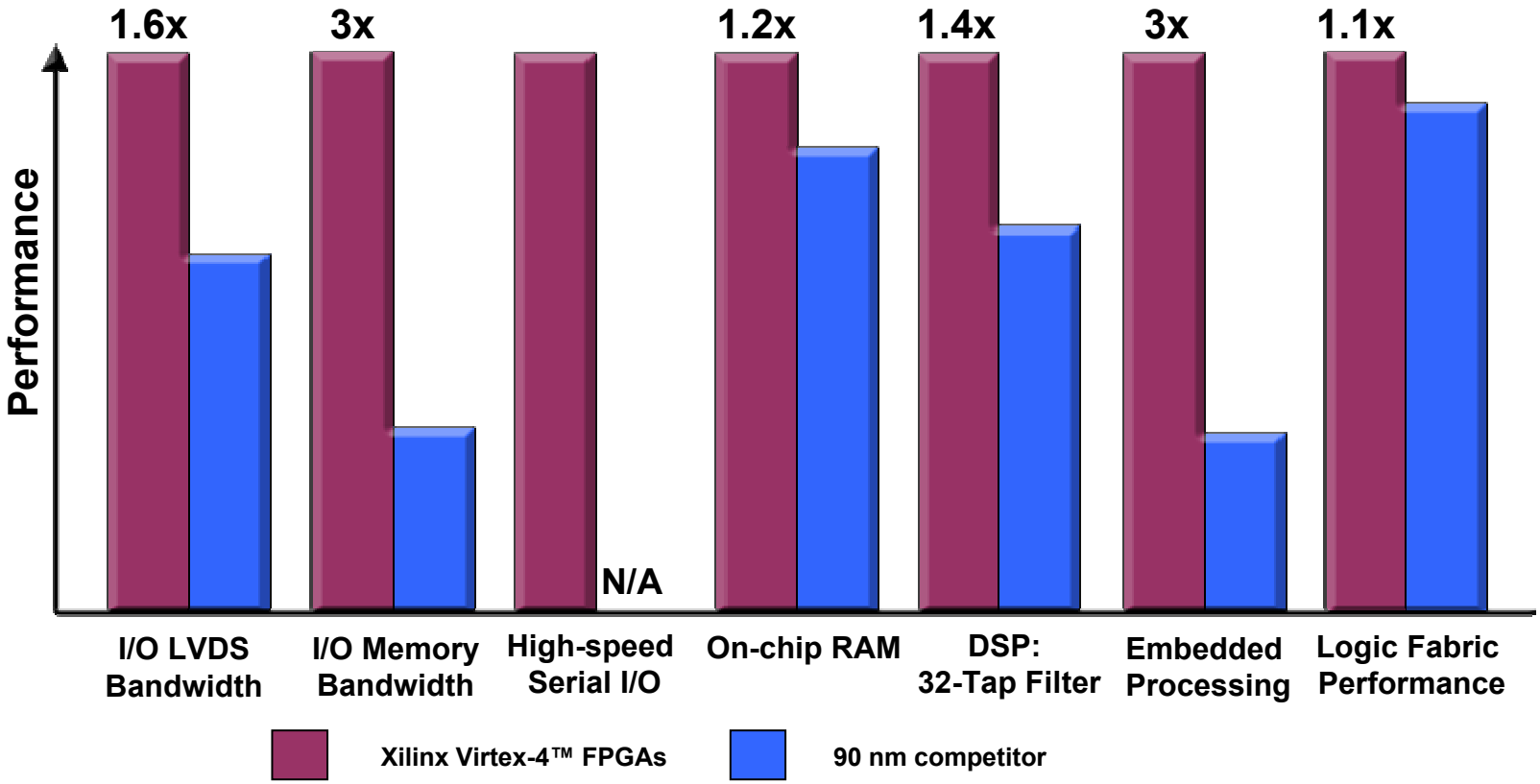
Better Functions = Higher Speed

The biggest performance boost comes from:

- Versatile clocking
- Parallel I/O and memory interfaces
- Serial I/O, multi-gigabit transceivers
- Memory (distributed RAM, BlockRAM, FIFOs)
- Expandable DSP slices
- Fast synchronous counters
- Embedded processing
- Fabric logic resources and interconnect structure

Functionality can triple the performance

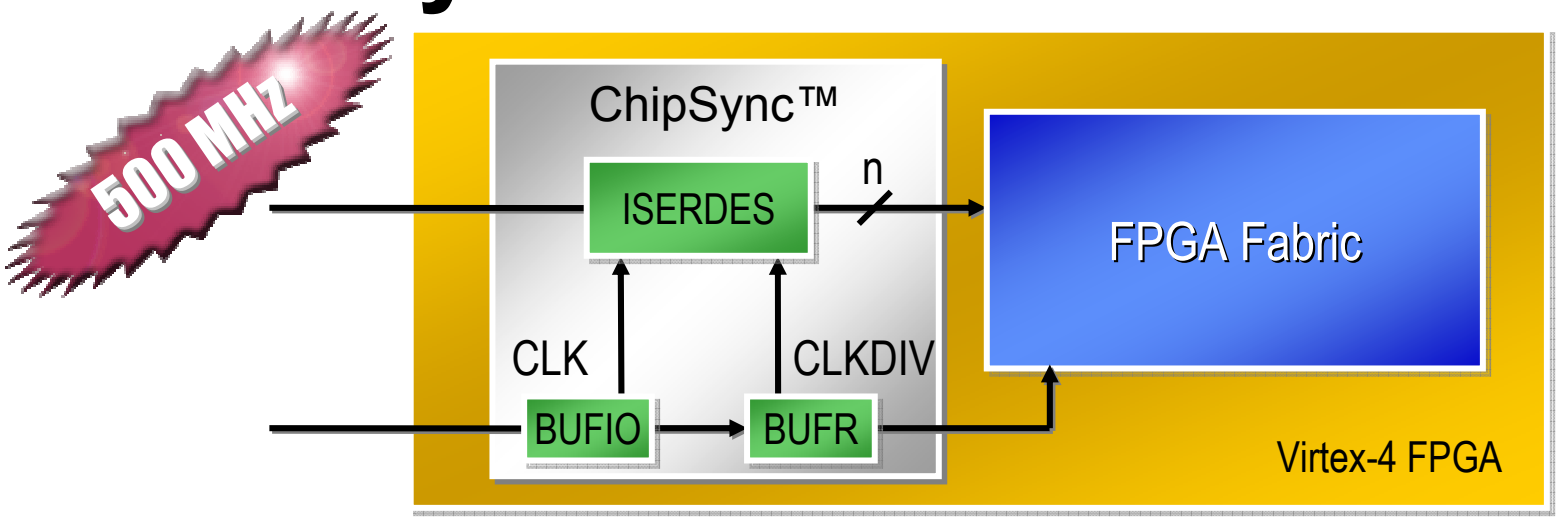
Virtex-4 Leads in 7 of 7 Performance Criteria



Data based on competitor's published datasheet numbers

Performance up to 3x higher than competing FPGAs

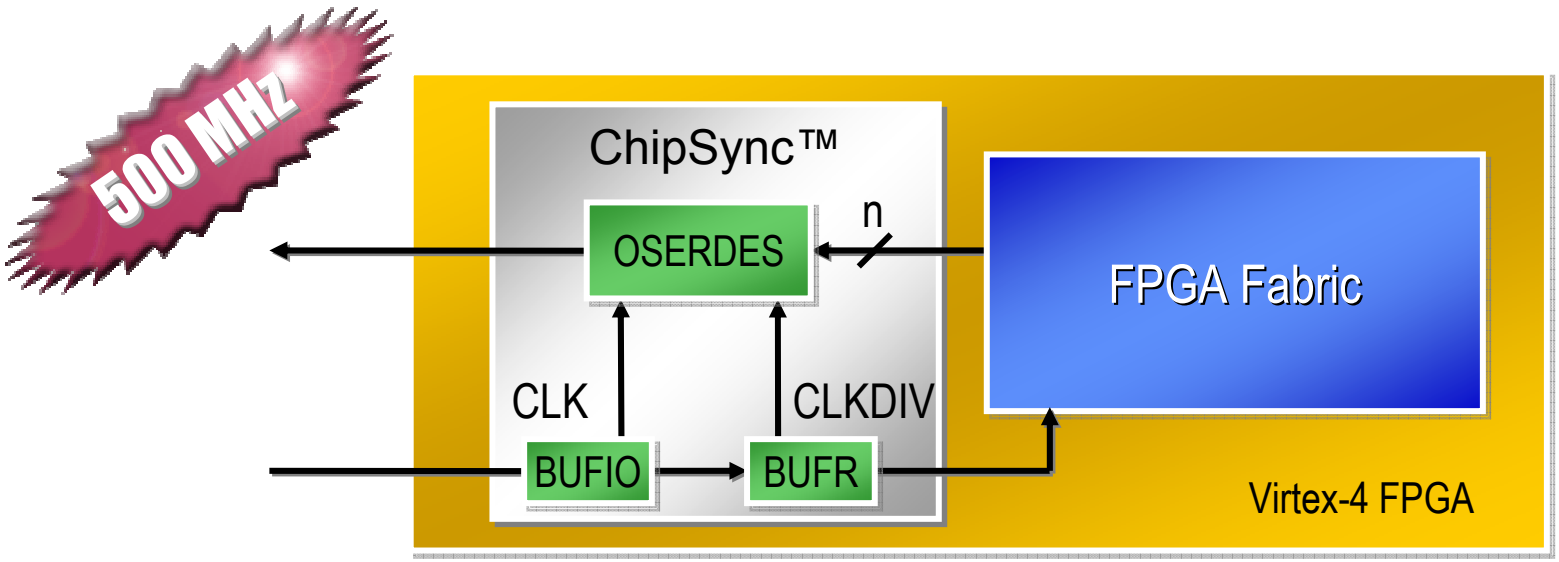
Built-in Support for Source-Synchronous Intefaces



- Serial-to-Parallel Converter on every input pin
  - Frequency division by 2, 3, 4, 5, 6, 7, 8 or 10
- Works in conjunction with IDELAY block
  - Dynamic signal alignment for bit, word, or clock
  - Supports Dynamic Phase Alignment (DPA)

Requires no resources in the fabric

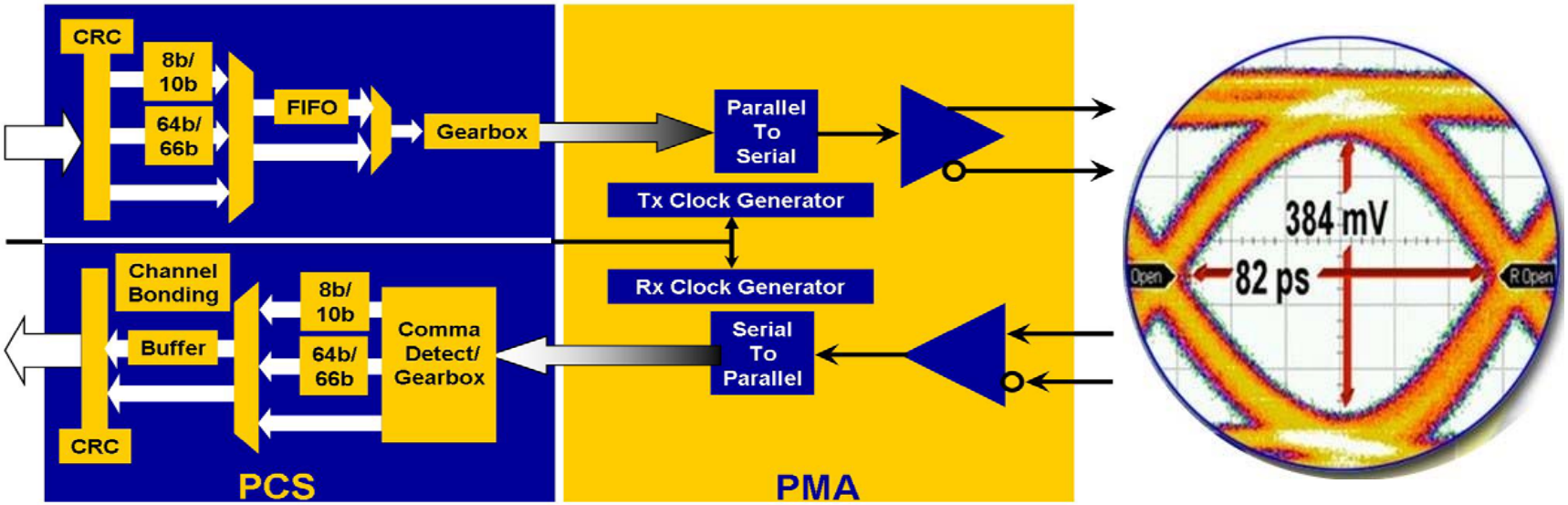
Built-in Support for Source-Synchronous Intefaces



- Parallel-to-Serial Converter on every output pin
  - Frequency multiplication by 2, 3, 4, 5, 6, 7, 8 or 10

Requires no resources in the fabric

Fastest Serial I/O



- **RocketIO™ transceivers**
  - Full-duplex w/ integrated SERDES, FIFOs, and CDR
  - 8-24 channels per chip, Data rate: 622Mbps-10Gbps
  - Transmit pre-emphasis, receive equalization

Fastest I/O in any FPGA

DSP Building Block

- FPGAs do high-performance DSP extremely well
  - Thanks to massive parallelism (500+ engines)
  - Fast clock rate, pipelined, high throughput
- Needs many fast Multiplier-Accumulators (MACs)
  - Dedicated, repetitive (systolic) structure
  - Slightly programmable, must be expandable

Build the fastest DSP implementations

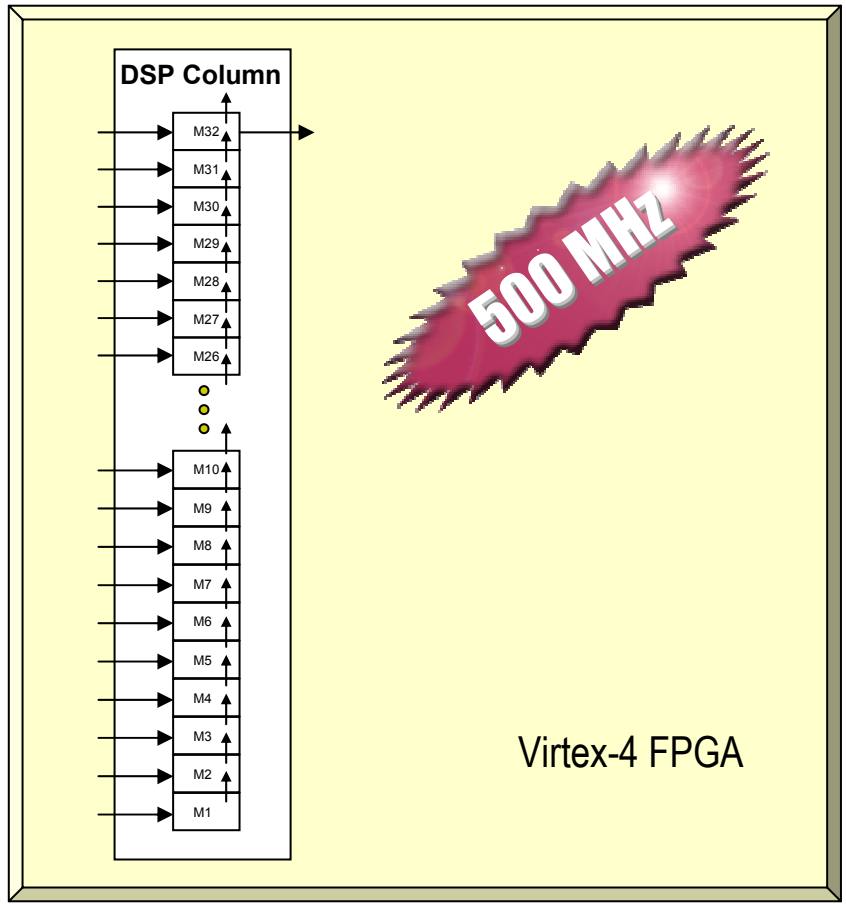
Unbeatable DSP Performance

ASMBL advantage:

- Cascade throughout vertical column without any help from the fabric
- Speed not affected by external adder tree
- 57% faster than the traditional approach

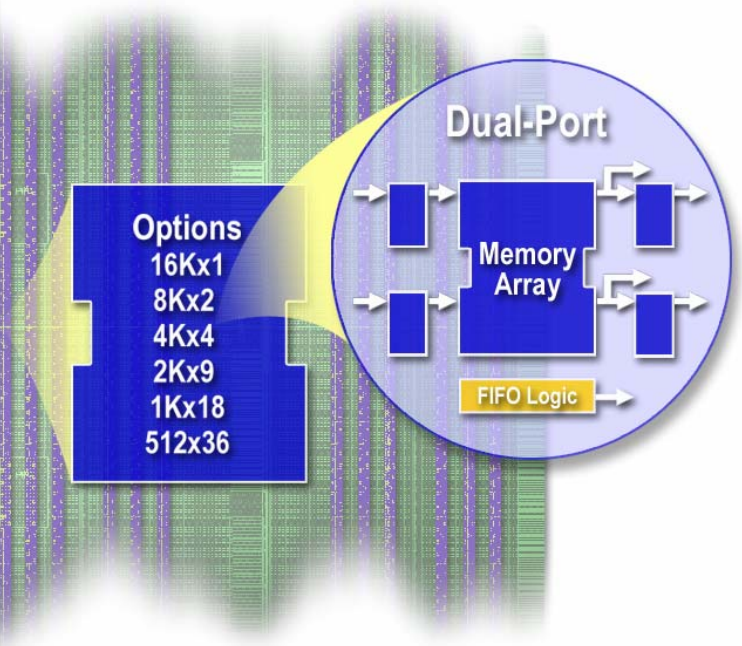
Example:
Systolic 32-tap FIR Filter

- **400** MHz in Slow grade
- **500** MHz in Fast grade



It helps to do things right!

Fast 18Kb-BlockRAM



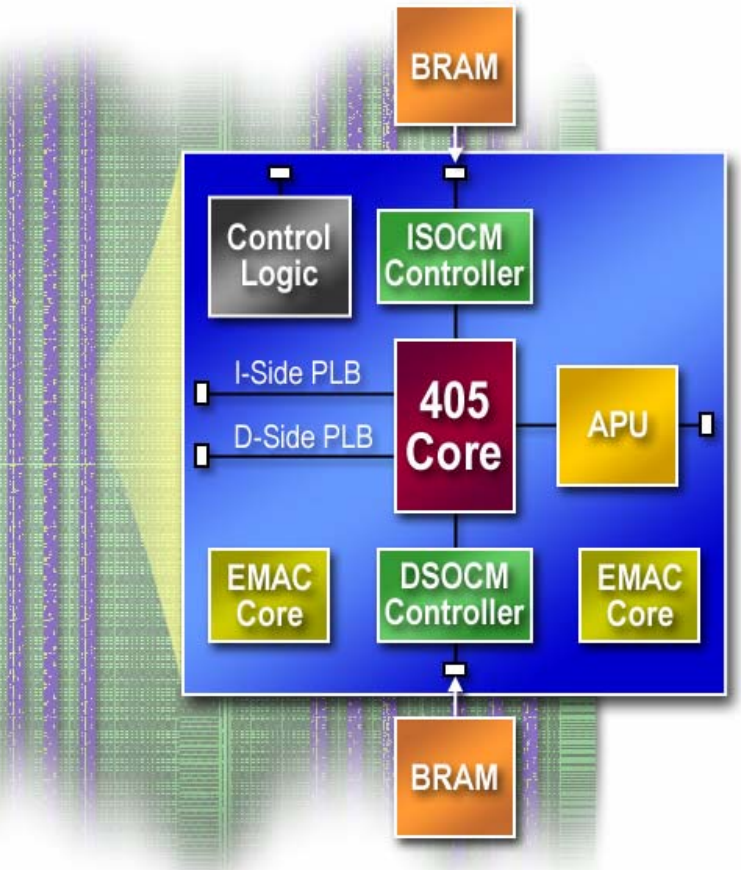
- Pipelined 500MHz synchronous operation
- Width-adjustable per port
- Read before write, or write before read
- Built-in FIFO controller in each BlockRAM
- Built-in Hamming error correction for 64 bits

Ideal for

- Microprocessor data / instructions and fast state machines

48 to 552 BlockRAM per chip

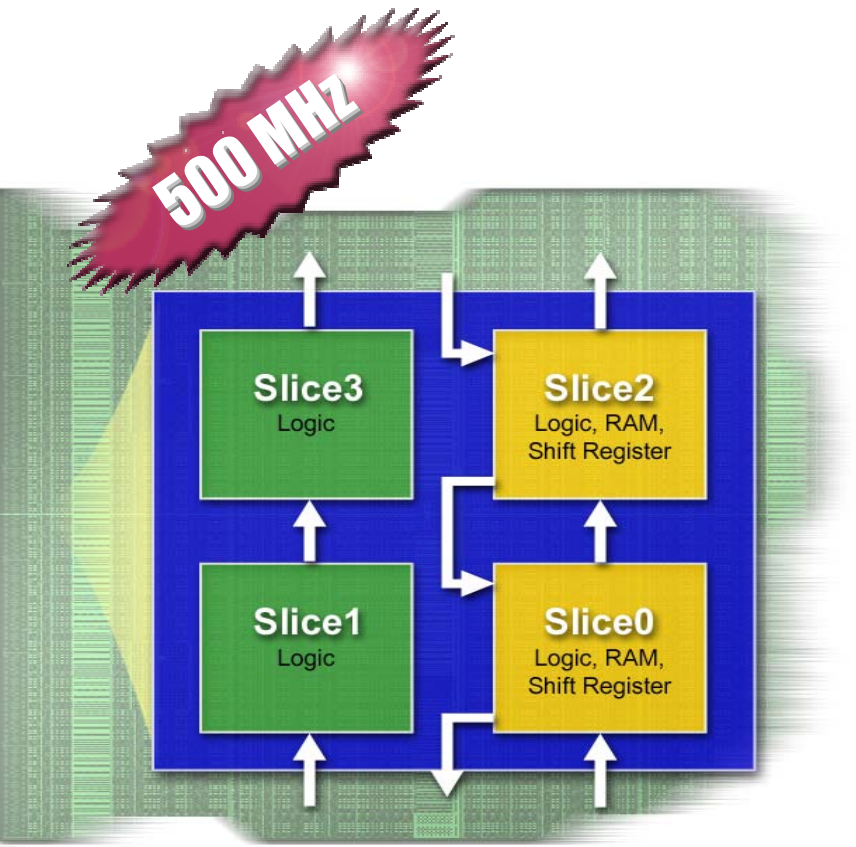
Highest-Performance FPGA Microprocessor



- **High-performance PowerPC Core**
  - Up to two cores per Virtex-4 FX device
  - 702 DMIPS per core
  - Integrated 16Kbyte Instruction Cache
  - Integrated 16Kbyte Data Cache
- **Acceleration through Auxiliary Processor Unit (APU) Interface**
  - Provides direct access from FPGA fabric to PowerPC core
  - High-performance coprocessor support

More than 3 times faster than any soft µP

Fabric Resources

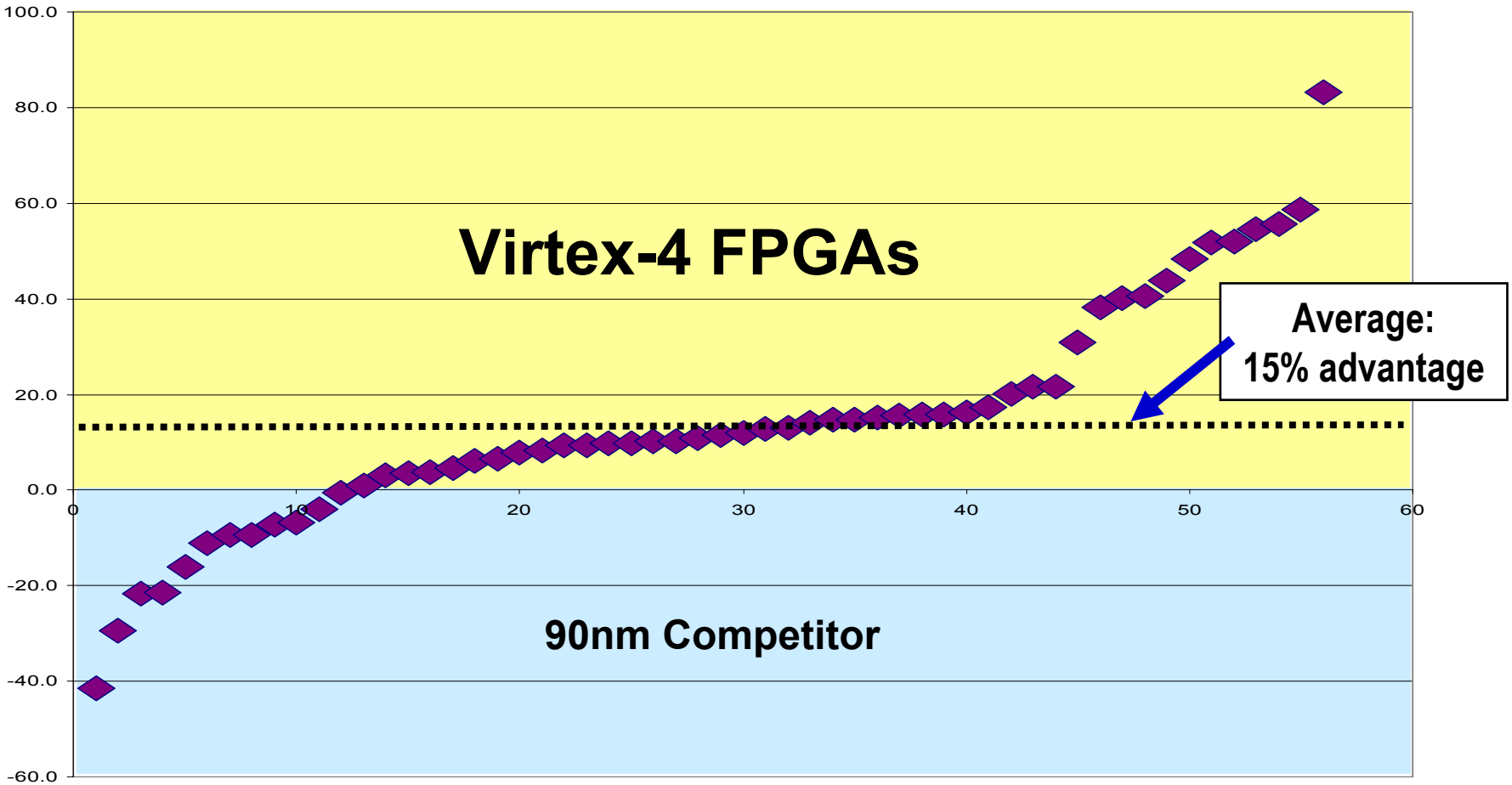


1 CLB = 4 Slices = 8 VLUTs

- Variable Look-Up-Table for:
  - Logic of 4, 5, 6 or 7 inputs
  - Distributed memory
  - 16-bit shift register, SRL16
- No shared inputs
  - Can pack unrelated functions
- Eight Flip-flops per CLB
- Fast carry

Logic and routing support 500 MHz operation

Benchmarks to Measure Fabric Performance



Logic performance testing of fastest speed grades using real customer designs and the best available tools

Summary

- Xilinx is **First in 90nm FPGAs**
  - 100x more devices shipped than by all other PLD vendors combined
- Virtex-4 is the **world's fastest FPGA**
  - Traditional benchmarks show performance advantage in fabric
  - New functions enable breakthrough performance + reduced power + lower cost