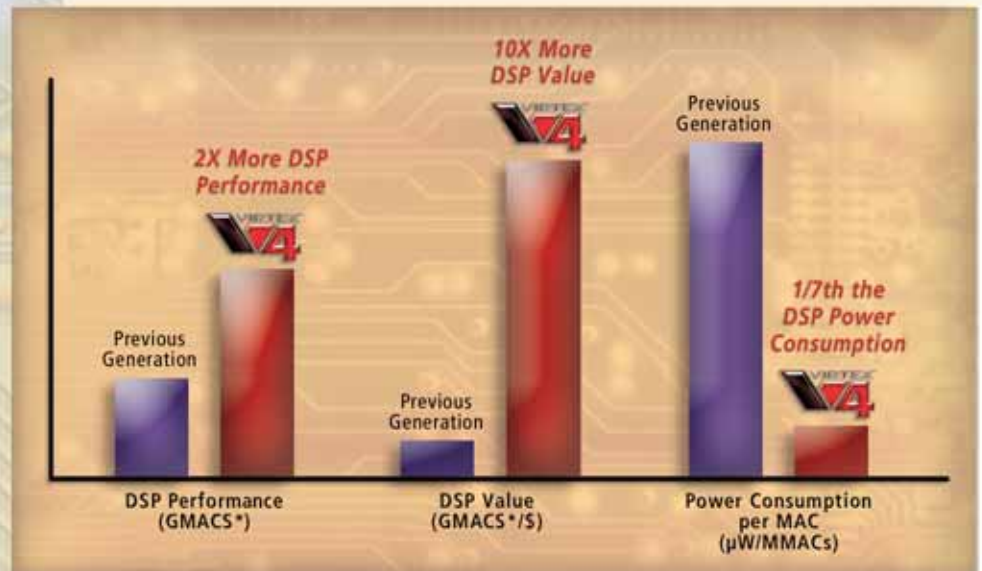# VIRTEX V4

Industry's Highest DSP Performance, Now at New Low Cost Points

Today's signal-processing systems demand increasingly higher performance and flexibility.

Xilinx Virtex-4™ FPGAs are ideally suited for high-performance signal-processing tasks traditionally serviced by an ASIC or ASSP. They allow you to create high-performance DSP engines that can boost the performance of your programmable DSP system by performing complementary co-processing functions in digital communications, video/imaging, and other applications. The Virtex-4 FPGA family is the newest and most powerful addition to the Xilinx XtremeDSP™ solution, providing blazing DSP performance with unrivalled economy. With up to 512 XtremeDSP slices operating at 500 MHz, these devices can implement complex tasks such as:

· Hundreds of IF-to-baseband down conversion channels

· 128X chip-rate processing for spread-spectrum systems

· High-definition H.264 and MPEG-4 encode/decode algorithms

The XtremeDSP solution accelerates your products' time-to-market through superior devices, design tools, intellectual property cores, and design services. This gives you the fastest means of designing, verifying, and deploying your DSP algorithms and systems in FPGAs.

10X More DSP Value

2X More DSP Performance

Previous Generation

1/7th the DSP Power Consumption

Previous Generation

Previous Generation

DSP Performance (GMACS*)   DSP Value (GMACS*/$)   Power Consumption per MAC (µW/MMACs)

XtremeDSP Slice Delivers Maximum Performance and Efficiency

The 500 MHz XtremeDSP slice delivers unmatched versatility, efficiency, and performance.

- Configure each XtremeDSP slice for over 40 DSP functions, such as multiply-accumulate, multiply, addition, and multiplexing
- Reduce DSP power consumption by 86% (57µW/MHz) and save precious logic resources for other tasks
- Cascade multiple XtremeDSP slices at full system speed to build complex filters and multi-precision functions

Optimized Performance and Cost for Your DSP Applications

All three Virtex-4 platforms offer XtremeDSP capabilities. Choose the device that provides the optimal ratio of DSP performance for your unique application.

- Virtex-4 SX devices offer the most cost-effective implementation of ultra-high-performance DSP functionality, with the highest ratio of XtremeDSP slices — up to 512 slices delivering up to 256 GMACS* performance
- Virtex-4 LX devices offer ample XtremeDSP slices and add more logic, memory, and I/O resources
- Virex-4 FX devices add embedded PowerPC™ processors and RocketIO™ multi-gigabit transceivers

Easiest-to-use Design Solutions for FPGA-based DSP

Xilinx and its partners provide complete solutions for rapid DSP development and implementation.

- Reduce design time with System Generator for DSP
- Implement fast, highly optimized algorithms with a rich DSP IP library
- Bring products to market faster with award-winning technical support and DSP services

* 18x18 bits, 48-bit accumulator

Versatile 500 MHz XtremeDSP Slices

The Challenge: Implement high-performance DSP algorithms more cost-effectively.

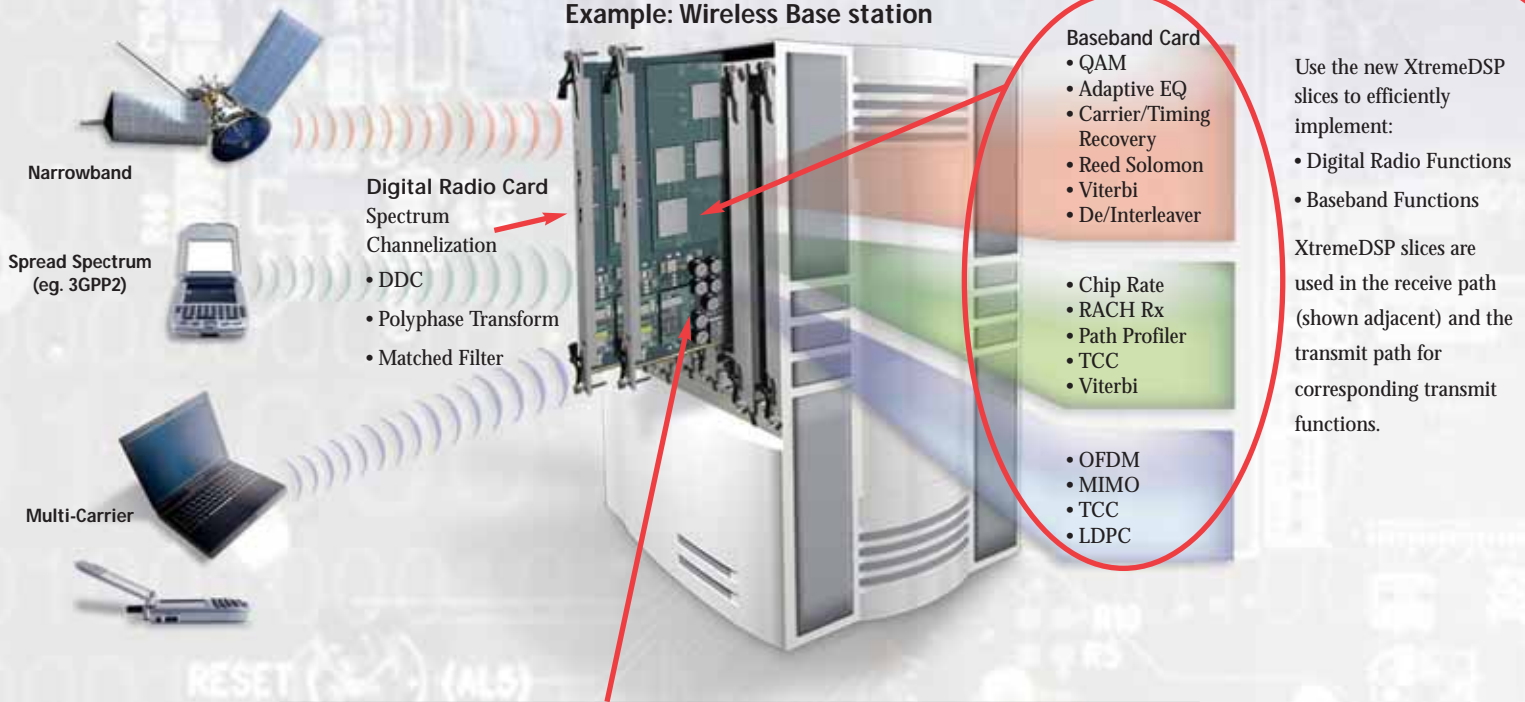**The Virtex-4 Solution:** Up to 512 new XtremeDSP slices

- 500 MHz throughput (256 GMACS overall performance) in 4VSX55
- 40+ arithmetic functions
- 1/7th the power compared to previous-generation FPGAs
- Directly cascadeable without loss in speed
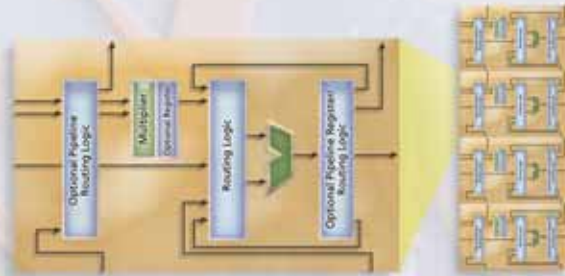
Digital Communication Systems

Whether you are working with spread-spectrum, multi-carrier, or narrowband communication systems, Virtex-4 FPGAs are the ideal choice.

Example: Wireless Base station

Narrowband

Spread Spectrum (eg. 3GPP2)

Multi-Carrier

Digital Radio Card
Spectrum Channelization
- DDC
- Polyphase Transform
- Matched Filter

Baseband Card
- QAM
- Adaptive EQ
- Carrier/Timing Recovery
- Reed Solomon
- Viterbi
- De/Interleaver

- Chip Rate
- RACH Rx
- Path Profiler
- TCC
- Viterbi

- OFDM
- MIMO
- TCC
- LDPC

Use the new XtremeDSP slices to efficiently implement:
- Digital Radio Functions
- Baseband Functions

XtremeDSP slices are used in the receive path (shown adjacent) and the transmit path for corresponding transmit functions.

Powerful Serial and Parallel Interfaces

The Challenge: Need to interface to DSP processors, memory, and other systems

The Virtex-4 Solution: Extremely flexible I/O interfaces

C6416

DSP Processors & ADCs and DACs
- Serial RapidIO
- EMIF etc.
- LVDS etc.

External Memories
DRAM
- DDR2, DDR
- SDRAM, RLDRAM II
- FCRAMII

SRAM
- QDRII, ZBT

System Interfaces
- Serial RapidIO
- PCI Express
- PCI
- HD-SDI
- Aurora
- CPRI, OBSAI

-Value FPGA for Signal Processing

Integrated Hard and Soft Microprocessors

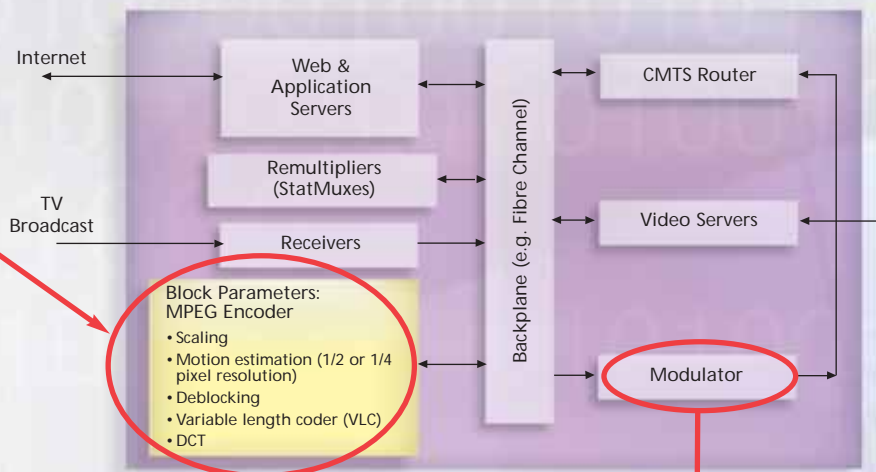**The Challenge:** Complex control and RTOS implementation.

The Virtex-4 Solution: A broad selection of 8- to 32-bit microprocessor systems and operating system support (VxWorks, Integrity, Linux, etc.)

PowerPC
MicroBlaze
PicoBlaze

- Hard 32-bit IBM PowerPC 405 cores in FX platforms for implementing advanced frameworks such as Software Communications Architectures (SCAs) for software-defined radio applications
- Xilinx PicoBlaze™ and MicroBlaze™ soft microprocessors for control circuits

Video/Imaging and Broadcast Systems

Example: Cable Head-end System

Block Parameters:
MPEG Encoder
- Scaling
- Motion estimation (1/2 or 1/4 pixel resolution)
- Deblocking
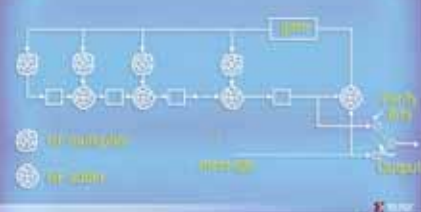- Variable length coder (VLC)
- DCT

Compact Multi-Channel Designs using SRL16s

The Challenge: Keep cost and power down for multi-channel signal-processing designs

The Virtex-4 Solution: Unique SRL16s enable you to achieve very high compute density and make efficient use of logic slices.
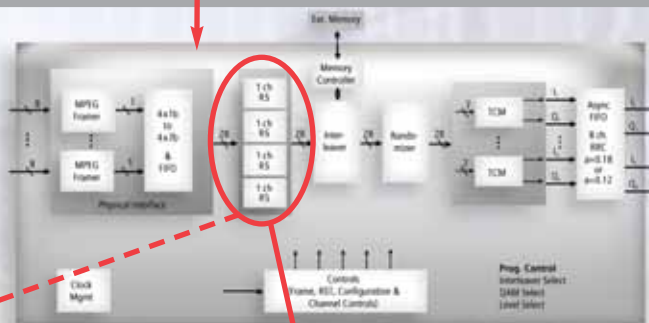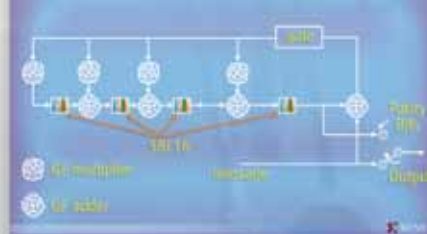

Single-Channel
Reed Solomon Encoder Replicated
16 times (without using SRL16s)

Using a single SRL16, a 16-channel Reed-Solomon encoder consumes only 10% of the silicon area compared to a design that simply replicates a single channel version 16 times.

Efficient 16-channel RS-Encoder
using a Single SRL16

Finish Faster with Xilinx DSP Design Solutions

## Xilinx System Generator for DSP

The industry's premier solution for FPGA-based DSP design enables you to:

- Generate high-performance DSP algorithms in FPGAs from a high level executable specification in Simulink®
- Accelerate simulations by orders of magnitude using your target hardware "in the loop" with Simulink or ModelSim®
- Import VHDL and Verilog modules directly into Simulink using a ModelSim co-simulation interface
- Specify state machine and other logic using MATLAB® code that is automatically compiled into RTL HDL

Pre-verified Signal Processing Algorithms as IP Cores

Xilinx and partners provide a range of DSP IP cores that are optimized for speed and cost.

- FEC: Reed-Solomon, Viterbi, TCCs, and others
- FFTs, Filters, and others
- Math functions: CORDIC, Multiplier, MACs, and others
- Video IP—Compression scaling and others
- Industry-standard DSP connectivity with Serial RapidIO, PCI, and EMIF
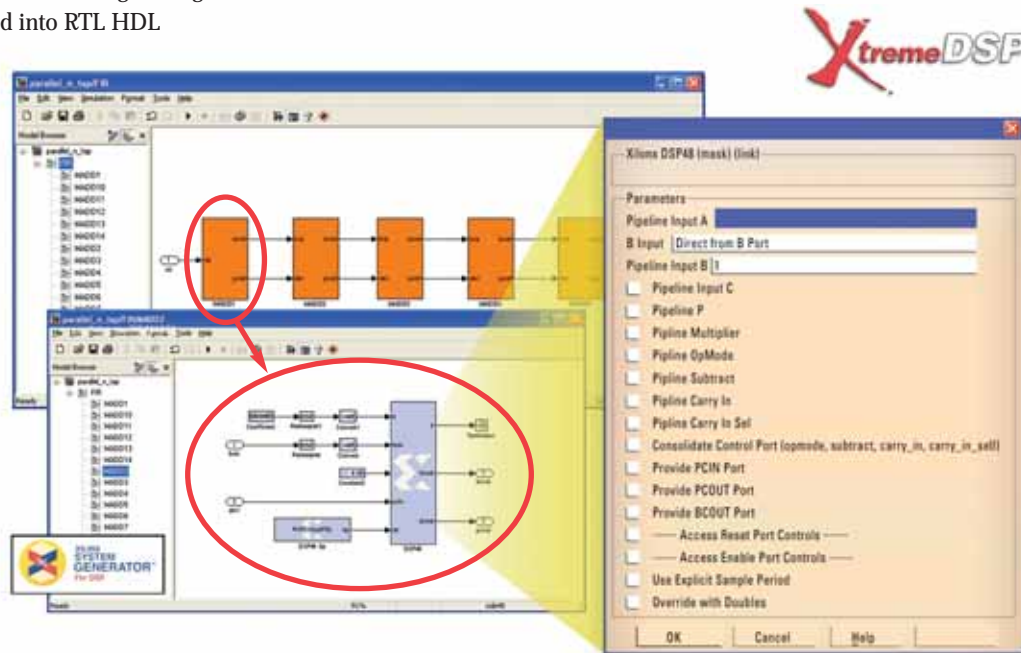
DSP Services and Support for Virtex-4 FPGAs

DSP Education Services

Reduce your time-to-knowledge with public, private, and online courses including:

- DSP Design Flow (three-day course)
- DSP Implementation Techniques for Xilinx FPGAs (three-day course)

DSP Support Services

Ensure the success of your DSP project with award-winning technical support, including:

- Industry's best support web site
- Free DSP hotline support
- Platinum DSP hotline support
- Titanium on-site AE support

DSP Design Services

Reduce your project risk by allowing our engineers to help you with:

- System architecting
- FPGA implementation
- IP core modification
- Turnkey system design

Take the Next Step

Learn more about achieving blazing DSP performance with unrivalled economy. Visit us online at **www.xilinx.com/virtex4**

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100 BEST COMPANIES TO WORK FOR

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Printed in the U.S.A.

PN 0010801