Design Methodology/SOPC Builder
Agenda

- Leadership in Programmable Logic Design Software
  - SOPC Builder
  - DSP Builder
  - Development Kits
- System-Level Design Solutions
- Software Design Tools Roadmap
20 Years of Altera Software Leadership

1980s: The Tradition Begins

- First PLD Vendor Software on MS Windows
- Software Superiority Drove Altera’s CPLD Leadership

2003: The Tradition Continues

- Quartus® II: Altera’s Flagship Software for CPLD, FPGA & HardCopy™ Devices
- Extends Altera’s Knowledge & Leadership into High-Density Devices
- Even More Powerful & Easy-to-Use
Quartus II Software: Logic & System Design

Megafuctions

- SOPC Builder
  - Embedded Systems
  - Nios® Processor
  - GNU Tools
  - RTOS

- Logic Design
  - Integrated Synthesis
  - Physical Synthesis
  - SignalProbe™
  - SignalTap® II

- DSP Builder
  - MathLab / Simulink
  - FPGA Co-Processors
  - Hardware Accelerators
  - Custom Instructions

EDA Partners

- Cyclone
- MAX
- HARDCOPY
- SOPC WORLD
- Stratix
- 20 YEARS OF ALTERA INNOVATION
Quartus II Overview

Logic Design

Basic PLD Development Flow

Idea

Architecture/Spec Development

Custom RTL Development

Functional Verification

IP Core Integration & Synthesis

Place-&-Route

Timing Verification & Debug

Hardware/Software Co-Development

Verification

Design

Quartus II Software Serves
- Design
- Compilation
- Verification

Compilation & Optimization

IP Cores

Third-Party Software

Functional Verification & Debug

Timing Verification & Debug

Hardware/Software Co-Development

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Design
Quartus II - Leadership in All Phases

- Design at System Level
- Block-Based Design
- Begin PCB Design Early

I/O Assignment Editor (partial screen)

- Integrated Synthesis
- Physical Synthesis
- Design Changes
  - Incremental Compile
  - Chip Editor

Faster Design Completion
Robust Debug:
  - SignalProbe
  - SignalTap II
PowerGauge™
Use Quartus II Software for All New Designs

Quartus II Advantages

− Access to All Altera® Devices
− Best Quality of Results
− Superior HDL Synthesis
− Advanced Features Support
Use Quartus II Software for ALL New Designs

Quartus II Software Includes Popular MAX+PLUS® II Features

- MAX+PLUS II Schematic Entry Features
  - Pin & Location Assignment Display in Schematics
  - Double-Clicking on Block or Symbol Opens Design File
- Graphical Compiler Window

- Edit Simulator Report Files Directly
- Stand-Alone Programmer
Quartus II Software Is Easy to Learn!

- New Manual Introduces Quartus II Design Flow
- Extensive On-Line Help
- Quartus II On-Line Tutorials
- Convert MAX+PLUS II Project Feature
- Easy-to-Use New Project Wizard
System Design Tools

**SOPC Builder**
- Stand-Alone Processor
- Processor + FPGA Logic

**DSP Builder**
- Dedicated Hardware Architecture
SOPC Builder Overview

SOPC Builder
From Concept to System in Minutes

- Timer
- USB
- Ethernet
- PCI
- DMA
- SDRAM Controller
- CPU
- Application Logic
- UART
SOPC Builder Overview

Simulation
Testbench
Generation

System Generation
VHDL / Verilog HDL

Software Development
Kit Generation

- C Header files
- Custom Library
- Peripheral Drivers
- RTOS
- Middleware
- Software IDE
- Software Debuggers

Model Technology
SOPC WORLD
2003
## SOPC Builder Ready Components

<table>
<thead>
<tr>
<th>Component</th>
<th>DMA</th>
<th>USB 1.1</th>
<th>SDRAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excalibur™ Stripe</td>
<td>DMA</td>
<td></td>
<td>SDRAM</td>
</tr>
<tr>
<td>Nios Processor</td>
<td>PCI</td>
<td>USB 2.0</td>
<td>SSRAM</td>
</tr>
<tr>
<td>ARM-to-Nios Bridge ARM (AMBA AHB-to-Avalon)</td>
<td>GPIO</td>
<td>SPI</td>
<td></td>
</tr>
<tr>
<td>Interface to User Logic</td>
<td>Timer</td>
<td>CAN 2.0</td>
<td>FLASH</td>
</tr>
<tr>
<td>10/100 Ethernet</td>
<td>Watchdog</td>
<td>16550S UART</td>
<td>On-Chip ROM On-Chip RAM</td>
</tr>
</tbody>
</table>

More than 50+ IP Cores Now . . .
the List Keeps Growing
DSP System Architecture Options

- Stand-Alone Processor
- Processor Array
- Processor + Co-Processor
- Dedicated Hardware Architecture

Performance (MACs/Sec)
DSP Builder Overview

- Creates HDL Code
- Creates Simulation Testbench
- Creates Processor Plug-in
- Download Design to Development Board
- Verify in Hardware

HDL Synthesis

Model Technology

MATLAB & SIMULINK

Design to Development Board

SignalTap II

SOPC Builder

Synthesis
FPGA Co-Processor Applications

- **Wireless**
  - 2.5G EDGE Equalization
  - 3G Baseband Processing
    - HSDPA
    - 1xEVDV
  - 3G RF Linearization

- **Consumer**
  - Broadcast - Studio & Cable Plant
  - Digital Entertainment – MPEG2 & MPEG4

- **Industrial**
  - Military-Aerospace
  - Software Define Radio
  - Security
  - Medical Imaging

- **Wireline Communications**
  - Encryption
  - Framer
  - Traffic Management
  - TCP/IP

- **Computer & Storage**
  - Data Analysis & Routing Engine
  - Digital Imaging
Application Development Kits

- Jump-Start Your Application
- Complete Solutions
  - FPGA-Centered Boards
  - Development Software
  - Reference Designs
  - Download Cables
  - Accessories
- Available from Altera & Third-Party Partners
- Targeted Areas: Embedded CPUs, High-Speed I/O Designs, Memory, PCI, Ethernet & DSP
- www.altera.com/devkits
Designing for HardCopy Stratix™ Devices

**Design Software**
- SOPC Builder
- DSP Builder
- Timing Optimization
- Chip Editor
- Power Estimator
- Design Space Explorer

**FPGA Prototyping**
- System Verification
- System Software Development
- Field Trial Production

**Production**
- Low Price
- Seamless Migration
- Higher Performance
- Lower Power Consumption

**QUARTUS® II**

**SOPC WORLD 2003**
## Designing for HardCopy Stratix Devices

<table>
<thead>
<tr>
<th>Comparison</th>
<th>ASIC</th>
<th>HardCopy</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDA Tool Cost</td>
<td>$200K</td>
<td>$2K</td>
</tr>
<tr>
<td>NRE/Masks/Prototypes</td>
<td>$700K</td>
<td>$200K</td>
</tr>
<tr>
<td>Time to FPGA Prototype</td>
<td>Not Available</td>
<td>6 Months</td>
</tr>
<tr>
<td>Time to First Units</td>
<td>14 Months</td>
<td>8 Months</td>
</tr>
</tbody>
</table>

**How Do You Want to Spend Your Resources?**
Stratix GX Development Kit

- 3.125-Gbps Transceiver (SERDES) Solution
  - Supports Various Data Rates
  - Supports Many Protocols
  - Supports Array of Connectors

- Full Reference Design
  - Board Layout Files
  - Design Examples
  - Out of Box Support
  - Quartus II Software Tools

- Part Number
  - HS-BOARD/SX40

Available Now
HardCopy Stratix Prototyping Kit

- HardCopy Stratix Prototyping Board
  - EP1S25F672 FPGA
  - 32 Mbytes SDRAM
  - 16 Mbytes Flash
  - Audio A/D & D/A
  - Keyboard & Mouse Port
  - VGA Port
  - USB 1.1
  - 10baseT Ethernet
  - LEDs, Switches

- Quartus II Software (1-Year License)

Start Your HardCopy Design Immediately!
Nios Development Kit
Stratix Edition

- Nios Processor Version 3.0
- Stratix EP1S10 Development Board
  - 1 MByte SRAM
  - 16 MBytes SDR SDRAM
  - 8 MBytes Flash
  - Compact Flash Connector & 16 MByte Card
  - 10/100 Ethernet MAC/PHY
  - Two Serial Ports (RS-232)
  - Two Daughter Board Expansion Headers
  - Mictor Connector (Debug & Trace)
  - 50-MHz Crystal (Socket), External Clock Input
  - Two Seven-Segment LEDs, Eight User LEDs, Four Pushbuttons

- SOPC Builder Design Tool
- Quartus II Software
- GNUPro Toolkit
- Network Protocols Software Library
- Evaluation Software
  - code\|lab Developer Suite
  - Nucleus Plus LV Real-Time Operating System
  - IAR visualSTATE Graphical Software Design Tool

Available Now
US$995
Nios Development Kit
Cyclone Edition

Nios Processor Version 3.0
Cyclone EP1C20 Development Board
- 1 MByte SRAM
- 16 MBytes SDR SDRAM
- 8 MBytes Flash
- Compact Flash Connector & 16 MByte Card
- 10/100 Ethernet MAC/PHY
- Two Serial Ports (RS-232)
- Two Daughter Board Expansion Headers
- Mictor Connector (Debug & Trace)
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SOPC Builder Design Tool
Quartus II Software
GNUPro Toolkit
Network Protocols Software Library
Evaluation Software
- code|lab Developer Suite
- Nucleus Plus LV Real-Time Operating System
- IAR visualSTATE Graphical Software Design Tool

Available Now
US$995
Nios Development Kit
Stratix Professional Edition

- Nios Processor Version 3.0
- Stratix EP1S40 Development Board
  - 1 MByte SRAM
  - 16 MBytes SDR SDRAM
  - 8 MBytes Flash
  - Compact Flash Connector & 16 MByte Card
  - 10/100 Ethernet MAC/PHY
  - Two Serial Ports (RS-232)
  - Two Daughter Board Expansion Headers
  - Mictor Connector (Debug & Trace)
  - 50-MHz Crystal (Socket), External Clock Input
  - Two Seven-Segment LEDs, Eight User LEDs, Four Pushbuttons

- SOPC Builder Design Tool
- Quartus II Software
- GNUPro Toolkit
- Network Protocols Software Library
- Evaluation Software

Available Now
US$2,495
DSP Development Kit
Stratix Edition

- Stratix EP1S25 Development Board
  - Analog I/O
    - Two 12-Bit, 125 MHz A/D Converters
    - Two 14-Bit, 165 MHz D/A Converters
  - Digital I/O
    - Four 40-Pin Connectors for Analog Devices A/D Converter Evaluation Boards
    - Connector for TI TMS320 Cross-Platform Daughter Card
    - 3.3-V Expansion/Prototype Headers
    - RS 232 Serial Port
    - 2 Mbytes of 7.5-ns Synchronous SRAM
- Quartus II Software
- MatLab / Simulink - 30 Day Evaluation
- DSP Builder
- Reference Designs
  - Filtering
  - DSSS Modem
  - QPSK Modem
  - DDC
- Labs
  - Digital Filtering
  - Error Correction (R-S) Network Protocols Software Library
- Ordering Code: DSP-BOARD/S25

Available Now
US$1,995
DSP Development Kit
Stratix Professional Edition

- Stratix EP1S80 Development Board
  - Analog I/O
    - Two 12-Bit, 125 MHz A/D Converters
    - Two 14-Bit, 165 MHz D/A Converters
  - Digital I/O
    - Four 40-Pin Connectors for Analog Devices A/D Converter Evaluation Boards
    - Connector for TI TMS320 Cross-Platform Daughter Card
    - 3.3V Expansion/Prototype Headers
    - RS 232 Serial Port
    - 2 Mbytes of 7.5ns Synchronous SRAM
- Quartus II Software
- MatLab / Simulink – 30-Day Evaluation
- DSP Builder
- Reference Designs
  - Filtering
  - DSSS Modem
  - QPSK Modem
  - DDC
- Labs
- Ordering Code: DSP-BOARD/S80

Available Now
US$4,995
PCI Development Kit
Stratix Edition

- PCI Development Board
  - Stratix EP1S25F1020C5 Device
  - In-Chassis or Stand-Alone Operation
  - Universal PCI/PCI-X Edge Connector
  - Double-Data Rate SDRAM (DDR333)

- Supports Conventional PCI & PCI-X
  - 32-Bit & 64-Bit Conventional PCI Up to 66-MHz
  - 32-Bit & 64-Bit PCI-X Up to 133-MHz

- Plugs into Any Desktop PC
  - Universal 3.3 v & 5 v
  - Short Card Form Factor

- Standard Expansion Ports
  - RS-232
  - 10/100 Ethernet

- Quartus II Software (1-Year License)
- Reference Designs & Applications

Available Now
US$1,995