Zynq-7000 All Programmable SoC
A Paradigm Shift for SoC-based Systems

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Demands of Today's Technology

Which Technology should you chose?
Current Selections Equal Compromise

<table>
<thead>
<tr>
<th></th>
<th>ASIC</th>
<th>ASSP</th>
<th>2 Chip Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System Performance</strong></td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td><strong>Total Power</strong></td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td><strong>BOM Cost</strong></td>
<td></td>
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<td></td>
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<tr>
<td>Unit Cost</td>
<td>+</td>
<td>+</td>
<td>-</td>
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<tr>
<td>TCO</td>
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<td></td>
<td>+</td>
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<tr>
<td><strong>Design Productivity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TTM</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Flexibility</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Scalability</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td><strong>Risk</strong></td>
<td>-</td>
<td>+</td>
<td>+</td>
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</tbody>
</table>

**Conflicting demands not served**

+ positive, - negative, ■ neutral
Xilinx Technology Evolution

Programmable Logic Devices
Enables Programmable Logic

All Programmable Devices
Enables All Programmable & Smarter Systems

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The First All Programmable SoC

Production: NOW

- 500+ unique customers actively designing
- 100+ AP SoC specific partners
- All major OSs supported and in use
- 20+ different development boards
- Multiple industry awards

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Zynq-7000 Family Highlights

Complete ARM®-based Processing System
- Dual ARM Cortex™-A9 MPCore™
- L1, L2 Caches and On-Chip Memory
- Fully Integrated Memory Controllers
- I/O Peripherals (CAN, USB, Ethernet, UART, …)

Tightly Integrated Programmable Logic
- Used to extend Processing System
- Scalable density and performance
  - 30k – 440k LCs, 80 – 2,020 DSP Blocks

Flexible Array of I/O
- Wide range of external multi standard I/O
- High performance integrated serial tranceivers
- Analog-to-Digital Converter inputs

Performance/power of an ASIC, flexibility of an FPGA, ease of use of an ASSP
Break-out in Customer Value

Build better processing systems with fewer chips… faster

Programmable Systems Integration

- Increased System Performance
- BOM Cost Reduction
- Total Power Reduction

Accelerated Design Productivity

ZYNQ™
Programmable Systems Integration

➤ ALL Programmable Platform Integrating Multiple Components
  – Hardware and Software programmable
  – Board component reduction
  – Security & reliability
  – Manufacturing benefits

➤ Enable Smarter system designs by
  – Create custom, flexible SoC to meet exact project needs in a single device
  – HW / SW partitioning optimized to specific application requirements
  – Optimized interconnect & I/O

➤ Most Efficient ARM + FPGA for Analytics & Control

The only SoC to integrate: Processor + FPGA + Signal processing + Analog in a single chip
Increased System Performance

Meet HW and SW Processing Performance Needs
- Dual Core ARM Cortex A9’s with NEON and vector floating point
- Programmable logic with massive DSP processing
- High throughput AMBA-4 AXI interconnect for fast data transfers (over 3000 PS to PL direct connections)
- High performance I/Os and transceivers supporting most interface standards

Optimized & Simplified HW/SW Partitioning
- HW acceleration enables scaling SW performance to address many applications
- Low latency interfacing for efficient co-processor implementation and high throughput data transfers

<table>
<thead>
<tr>
<th>Elements</th>
<th>Performance (up to)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processors (each)</td>
<td>1GHz</td>
</tr>
<tr>
<td>Processors (aggregate)</td>
<td>5000 DMIPs</td>
</tr>
<tr>
<td>DSP (each)</td>
<td>741MHz</td>
</tr>
<tr>
<td>DSP (aggregate)</td>
<td>1334 GMACs</td>
</tr>
<tr>
<td>Transceivers (each)</td>
<td>12.5Gbps</td>
</tr>
<tr>
<td>Transceivers (aggregate)</td>
<td>200Gbps</td>
</tr>
<tr>
<td>SW Acceleration</td>
<td>&gt;10x</td>
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SW Acceleration

- For software focused applications
  - SW code typically already exists
- Data typically resides in caches or OCM
- ACP enables lowest latency
- Typically greater than 10x SW acceleration

System Acceleration

- For data streaming applications
  - Control Plane / Data Plane
- Data resides in OCM or DDR
- Direct access to memory from PL
- Up 100x+ performance gain compared to SW

~20x w/ FPGA Acceleration

~70x w/ FPGA Acceleration

~12x w/ FPGA Acceleration

5x w/ NEON

SW and system acceleration beyond most ASSP's performance
BOM Cost Reduction

- **Reduced Devices per Board**
  - Processors, PLDs, DSPs
  - A/D converters
  - Power supplies, fans, etc…

- **Reduced PCB Complexity**
  - Fewer traces/interconnect/layers
  - Fewer power supplies
  - Smaller overall PCB

- **In-System Reconfiguration Combines Multiple Device Functions**
  - Reconfigurable programmable logic to provide specific functionality at a given time

- **PS Aggregates Numerous IP Royalties for Net Cost Benefit**
  - ASIC or full FPGA solutions would require purchase of these IPs from 3rd parties.

Platform approach enables higher volumes and lower prices
Total Power Reduction

▶ Flexible/Tunable Power Envelope
  – Adjustable processor speed
  – Adjustable AXI & memory speeds
  – ARM low power states
  – Programmable logic can be turned off
  – Programmable logic clock gating
  – Partial reconfiguration to reduce
    Programmable logic requirement

▶ Integration Power Reduction
  – Reduced interconnections between devices
  – Fewer system devices
  – Lower programmable logic power (28nm HPL process)

ZYNQ offers significant system level power savings
Accelerated Design Productivity

Industry Leading Tools
- Vivado IP & System Centric SoC Design Suite including next generation high-level design tools (Vivado HLS & Vivado IPI)

Large Selection of Open Source and Commercial OS
- Scalable solution ranging from Real Time OS to fully featured Operating Systems including Multi-core support in SMP and AMP mode

Large variety of development platforms
- Xilinx and 3rd party development kits
- Open source and commercial virtual platforms

Extensive Ecosystem
- Strong and rapidly growing global partner and other 3rd party support
- Industry leading OS’s, tools, IP, system integration/design houses

If you are an ARM developer, You are a ZYNQ developer
Accelerated Design Productivity
Parallel Developments of your AP SoC Based Application

- Processor boots first like any ARM based SoC.
- SW developers can use their favorite SW tool to load / debug SW code over JTAG
- Programmable Logic patiently waiting for configuration

- Reference SW boots processor first leaving PL up and ready to be programmed through JTAG
- Vivado Probe connects to Programmable Logic like to any other FPGA
- FPGA developer can start loading / debug like for any FPGA

SW developments like any other ARM based SoC
HW developments like any other Xilinx FPGA
Accelerated Design Productivity
More than an SoC, a Programmable Scalable Platform

► Reduced Time To Market
  – Fixed processor system with large set of built-in peripherals
  – Scalable optimized architecture for IP re-use;
  – Standardized AXI interfaces for plug & play IP
  – Accelerate development with design platforms for targeted market segments (TDPs)

► Increased Time In Market
  – Software and hardware re-programmability
  – Field upgradable
  – Address Processor/ASSPs short shelf life

Platform approach enables Horizontal and Vertical Scalability
Platform for a Wide Range of Applications

Driver Assistance
- Broadcast Camera
- Military Radios

Consumer Equipment
- Medical Imaging
- Wired Communications
- Wireless Communications
- AVB Routers, Switches

ARM Dual Core Cortex-A9 MPCore with Peripherals
- Up to 866MHz
- 1066Mbps DDR3
- 28k, 74k & 85k LC FPGA Fabric
- 80, 160 and 220 DSP Slices
- High Reliability I/Os
- 6.25Gbps Transceivers (7015)
- PCI-Express Gen2 (7015)

Kintex-7 Fabric
- 125k, 350k & 444k LC FPGA Fabric
- 400, 900 & 2,020 DSP Slices
- High Reliability & High Performance I/Os
- 12.5Gbps Transceivers
- PCI-Express Gen2

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Design Example: Machine Vision

Key Features Include:
- High Resolution VGA to 10 Mpx sensors
- Varying resolution supporting 5-120 fps
- Image Signal Processing
- Wide Dynamic Range
- Intelligent Video Analytics
- Low footprint H.264 Encoding
- Flexible Video output Interfaces

Zynq Value Proposition

Programmable Systems Integration
2+ Chips $\rightarrow$ 1 Chip

System Perf
2x

BOM Cost
-25%

Total Power
-45%

Accelerated Design Productivity
Proven Productivity using Partners

All Programmable Abstractions and Automation

- Industry leading high-level synthesis
- C, C++, SystemC, IP-based design
- MathWorks, National Instruments, Topic

Comprehensive Software Tools

- Free SDK from Xilinx
- Full support for ARM DS-5 tool chain
- All major software OS / tools supported

Ready to Use Solutions

- >20 boards and SoM available
- Large Selection of AXI-based IPs
- Many segment solutions readily available
Smartest Solution Summary

**Zynq-7000**

**Enabling Smarter Systems**
- Efficient ARM + FPGA for analytics & control
- Extensive OS, middleware & stack ecosystem
- High level of security & reliability

**Best Performance and Power**
- First dual 1GHz ARM Cortex A9 Processor
- High performance memory system
- Lowest power and fastest logic fabric

**Proven Productivity**
- Industry leading High Level Synthesis
- Wide selection of SW environments & tools
- Large portfolio of IP, design kits & reference designs
Thank You

More Info:

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