logicBRICKS™

Designed by XYLON

XILINX

ALL PROGRAMMABLE™

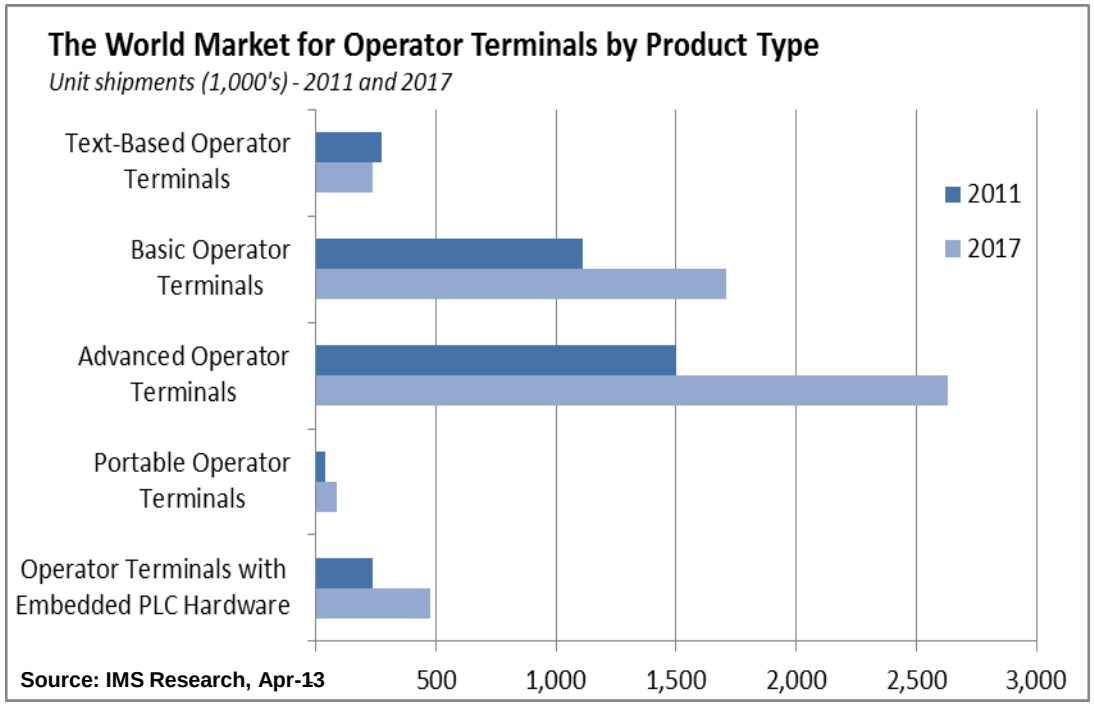
Click and Drag Your HMI Into the 21st Century

Hyuk Kim – Processor Specialist

Sep 30, 2014

HMI – Human Machine Interface

Types



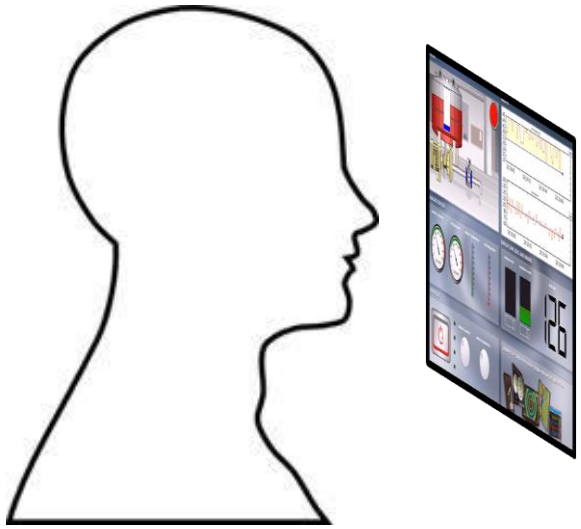
Our Focus:

- Graphical, touch-based HMIs
- High End HMIs
- HMIs Integrated with Embedded Systems

Goals of this Webinar

- Build high performance, low power, integrated HMIs
- Accelerate productivity with tools and graphics solutions
- Platform based design to reduce recurring engineering effort

Characteristics of 21st Century HMIs



- Detailed Graphics
- Embedded Real-Time Systems
- Interactive & Intuitive - Touch
- System Connectivity
- Integrated Video
- Functional Safety, Security, Reliability

HMI Applications

Intuitive Access to Complex Systems

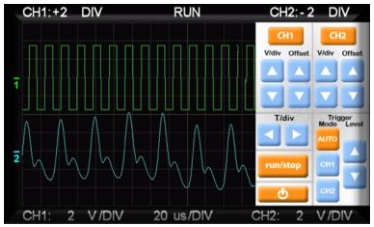
- Data Visualization
- Simple Control
- Enable Smarter Embedded Systems

Industrial Automation

Medical

Automotive

Test



+ Marine, Avionics, Military,…

Challenges of Building HMIs

- **Embedded System Integration**
  - Real-time, high performance processing
  - Connectivity
  - Small form factor
- **Performance**
  - Vs. Cost
  - Vs. Power
- **Productivity**
  - Graphics libraries, UI frameworks, graphics processing implementation
  - Accelerate to hardware
  - Reduce engineering effort for product derivatives

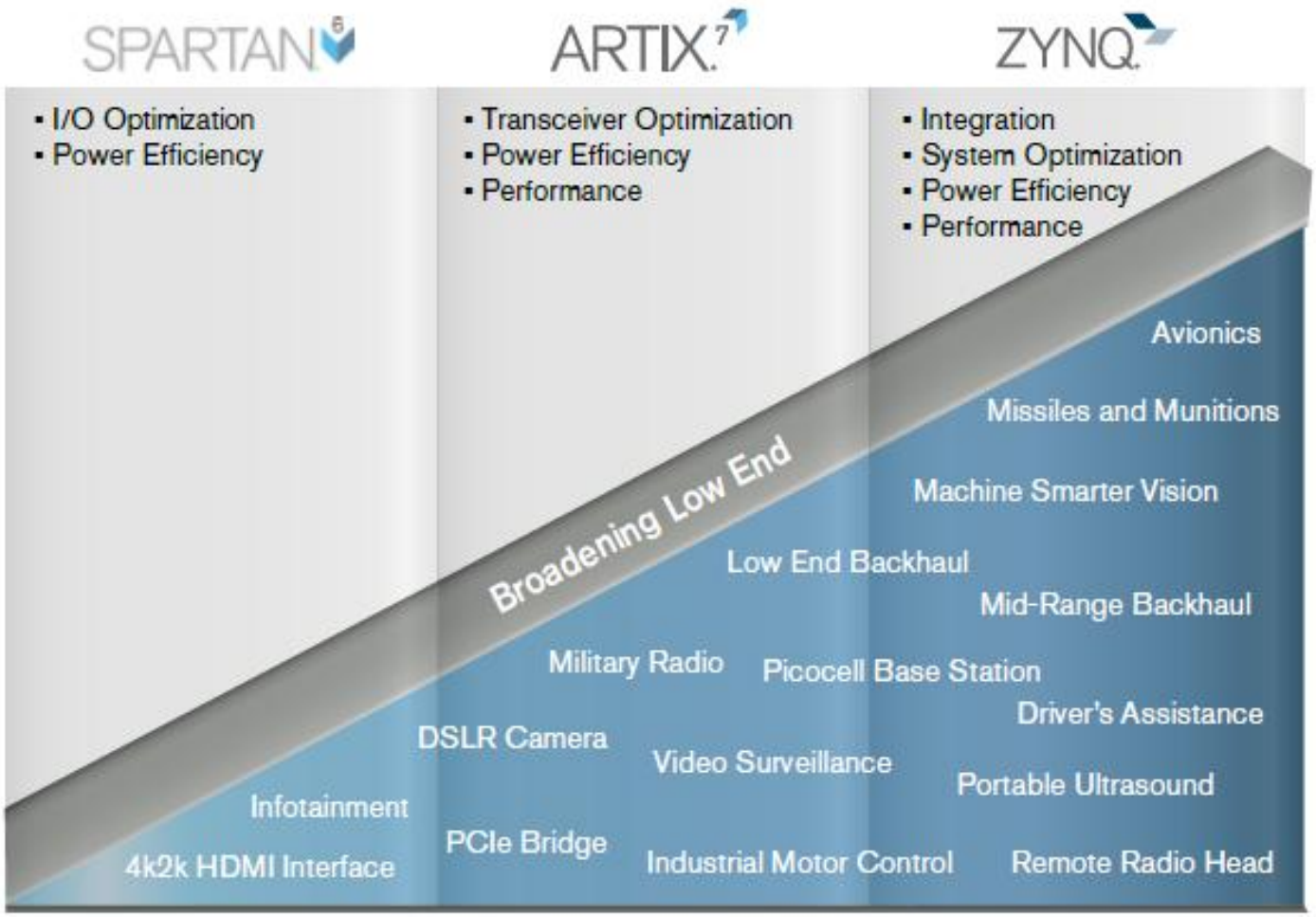
Building HMIs
Introduction to Xilinx

- **With over 3,500 patents and 60 industry firsts, Xilinx is known for its historic achievements including the introduction of the first FPGA and the first All Programmable SoC**

- **Used across many applications**
  - Avionics, MILCOM
  - Space
  - Industrial
  - Smart Grid
  - Medical
  - Automotive
  - Broadcast
  - Consumer
  - Wired/Wireless
  - Test & Measurement
  - Computing & Storage

- **Long product lifetime**

Low-end Products Address a Diverse Range of Applications



Building HMIs
Single Chip Solution with Xilinx

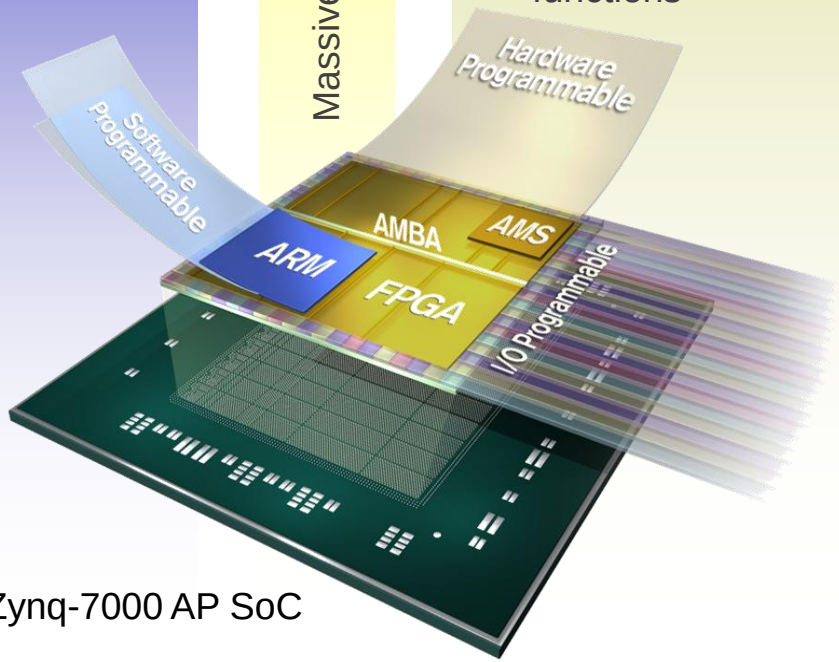
ARM® Processing System

- OS/RTOS
- 61131/PLC Runtime
- Motion control
- HMI application s/w
- Communication
- AMP - Dual Processor

Massive Parallel Data Interface

High Performance FPGA

- CPU offloading
- Graphics acceleration
- Custom backplane
- Video codec
- Functional Safety
- Custom hardware functions



Zynq-7000 AP SoC

Integrated ADC

- Touch
- System monitor
- Functional Safety

Connectivity

EtherCAT
EtherNet/IP
Modbus/TCP
SERCOS interface
ETHERNET POWERLINK
PROFINET
CC-Link

Zynq® AP SoC Graphics HMI Screenshots

From Xylon logicBRICKS Demo Applications

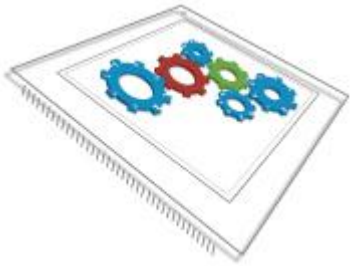
XILINX ALL PROGRAMMABLE

HMI Graphics Solutions

logicBRICKS™
Designed by XYLON

- Long-term Xilinx Premier Partner Xylon provides complete high performance embedded 2D, 2.5D, 3D graphics solutions for Xilinx SoC and FPGAs

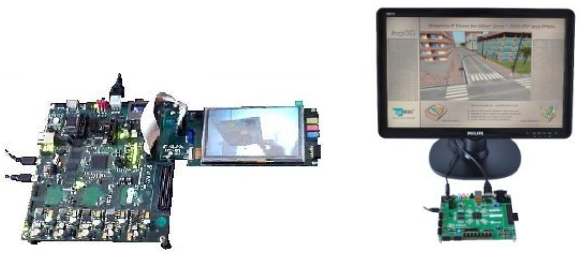
- HW Engineers can quickly integrate graphics HMI with their “secret sauce” application through Xilinx tools GUI



- SW Engineers can work with the HMI with no knowledge about the underlaying hardware and with familiar tools

- Accomplish business goals through a greater flexibility and differentiation in less time and lower costs

Xylon 2D/3D Graphics Offerings for Xilinx

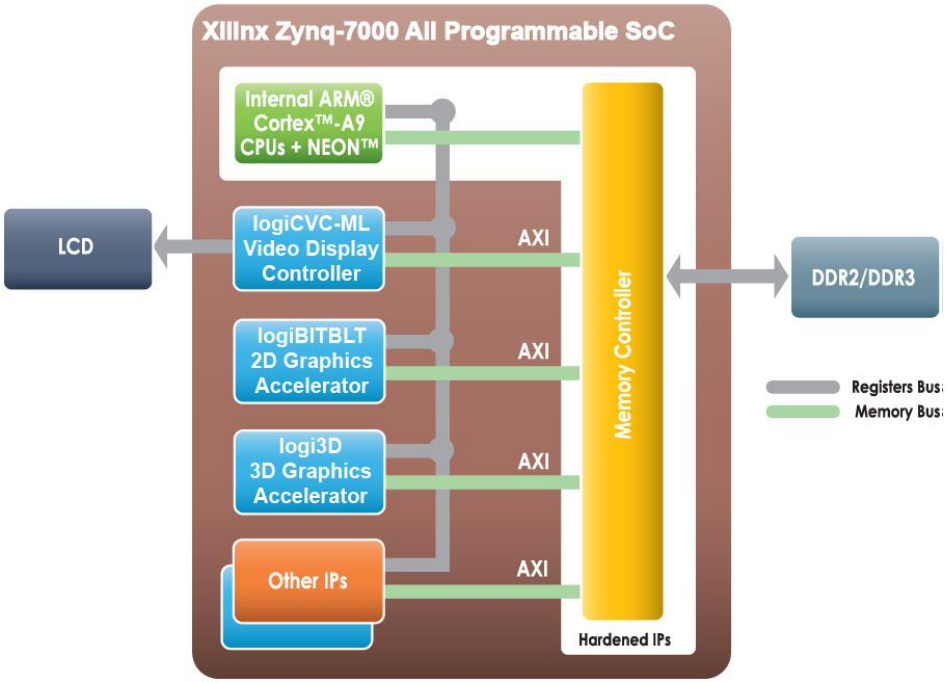


- Plug and Play IP cores for Xilinx Vivado® and ISE® that can be configured and optimized by the end user
- Available SW support for different OS and bare-metal: Linux, Android, Windows EC, QNX
- Work out-of-box with industry standard graphics libraries (DirectFB), APIs (OpenGL ES 1.1, DirectX...) and widget toolkits like Qt

DirectFB Qt OpenGL|ES

- Free evaluation IP cores available through Xylon web shop
- Dedicated Tech Support Team removes obstacles and speeds up customer projects; assured IP maintenance

Anatomy of the Graphic Engine



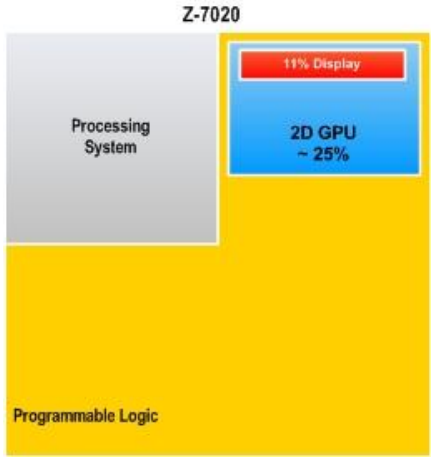
logiCVC-ML Multilayer Display Controller

logiBITBLT 2D Graphics Accelerator

logiBITBLT 3D Graphics Accelerator

logiBMP Bitmap 2.5D Accelerator

logi3D Scalable 3D Graphics Accelerator



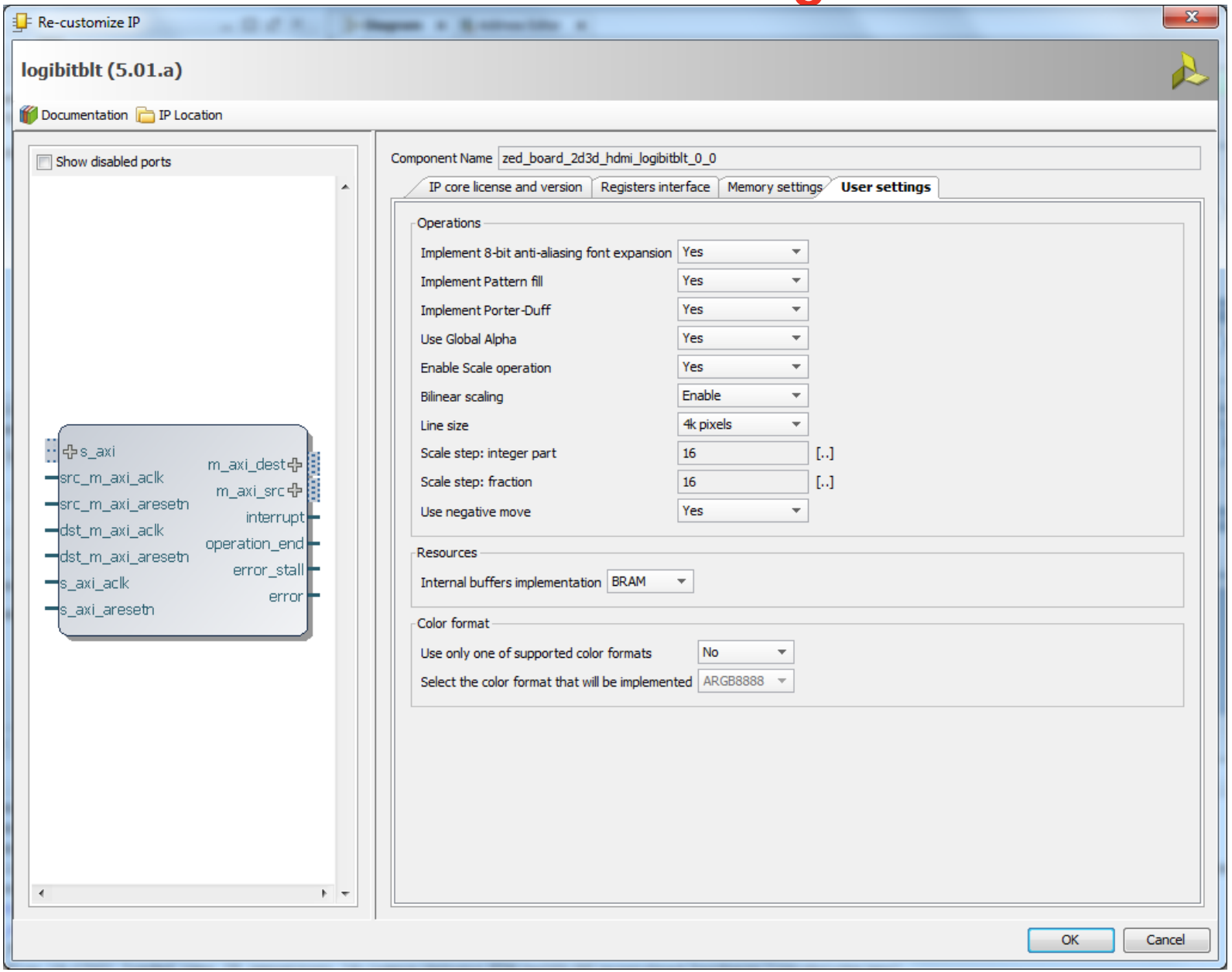
Applies to the fully-featured 2D graphics engine and can be scaled down

- **Control the size of the grahics HMI:**
  - **Use only needed IP cores**
  - **Use only needed IP features**
  - **Influence implementation details**
  - **Let Xylon tune it up for you**

Graphics rendering processor vs. FPGA

http://www.logicbricks.com/logicBRICKS-IP-Library/Video-Galleries/logicBRICKS-2D-Graphics-Acceleration.aspx

Vivado IPI – IP Core Configuration GUI



Xilinx / Xylon HMI Pre-Verified Ref Designs

Xylon offers several free pre-verified reference designs for Xilinx Zynq AP SoC

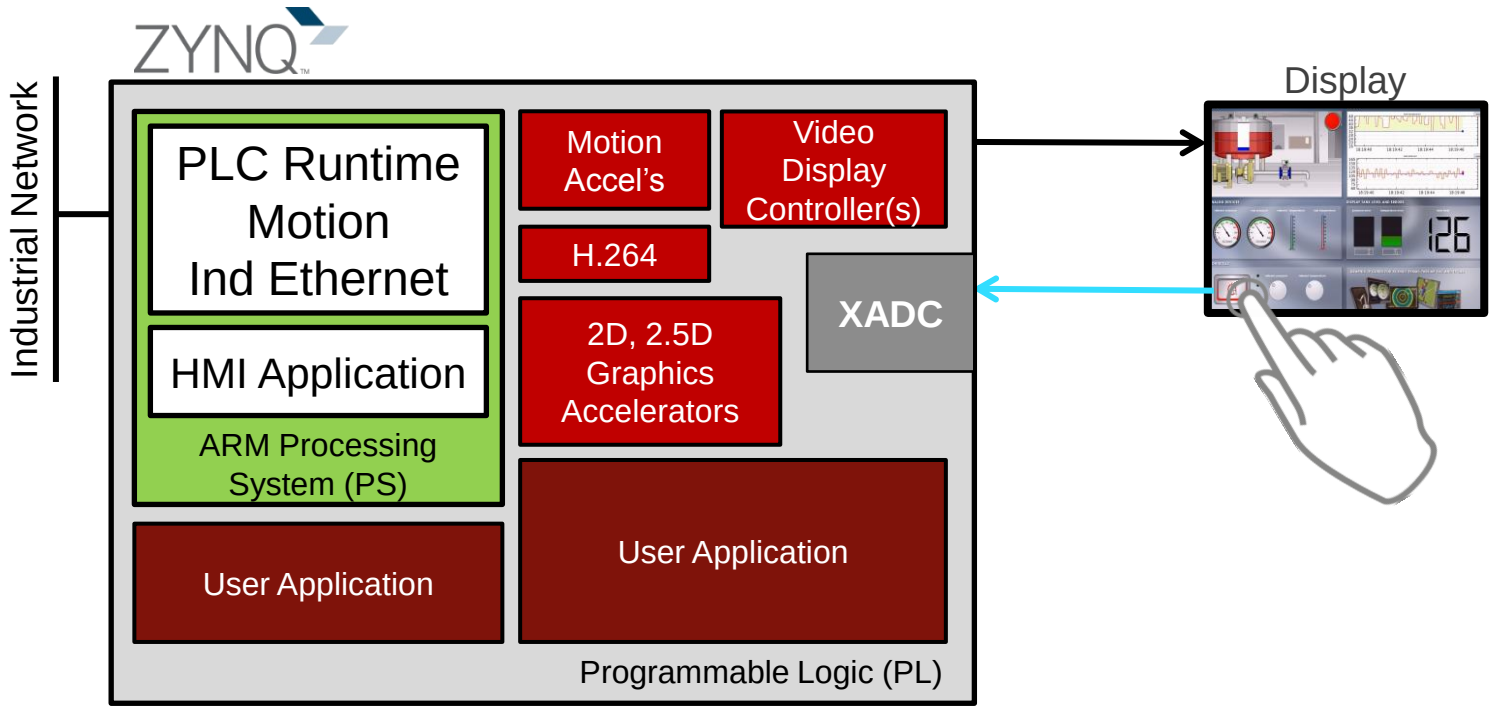
Download from: http://www.logicbricks.com/logicBRICKS/Reference-logicBRICKS-Design.aspx

- **Available on hardware from Xilinx (ZC702/ZC706), Avnet and TED**
- **Works "out-of-box"**
- **Includes**
  - Evaluation logicBRICKS IP cores (run-time limited)
  - Complete OS image, software drivers and demo applications
  - Documentation
- **Industrial HMI demo included with:**
  - logiREF-ZGPU ref. design for the ZC702
  - logiREF-ZGPU-ZED ref. design for the ZedBoard

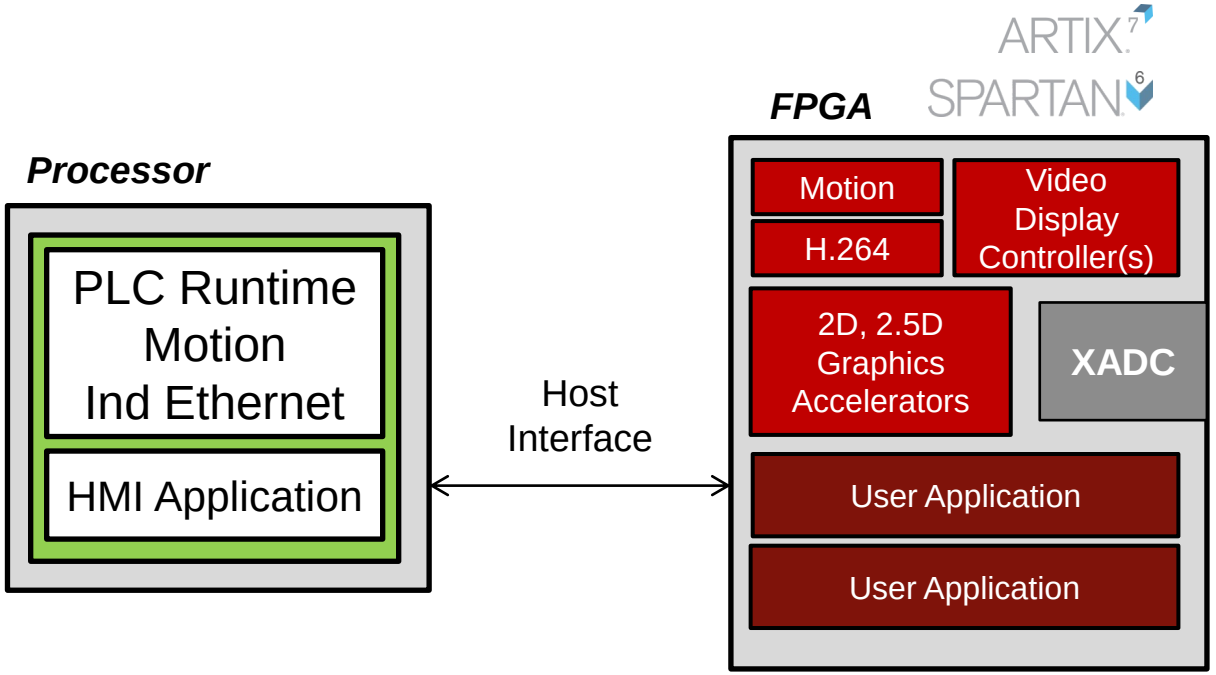
Industrial HMI demo for ZedBoard and ZC702 kits

Building HMIs
Single Chip Solution

- **Example: High Performance Industrial HMI**
  - Integrated Programmable Logic Controller (PLC)
  - Integrated Industrial Ethernet
  - Integrated Motion Control
  - Integrated Video with H.264

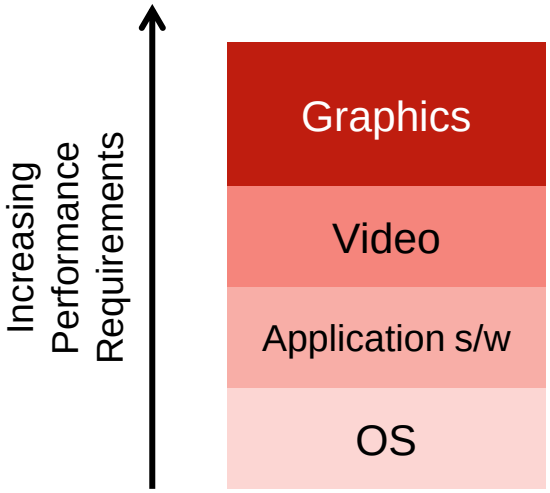


Building HMIs
Processor + FPGA



- **Benefits:**
  - Custom hardware functions in FPGA
  - Versatile, scalable connectivity
  - Graphics accelerators in FPGA
  - Can use lower cost processor of your choice

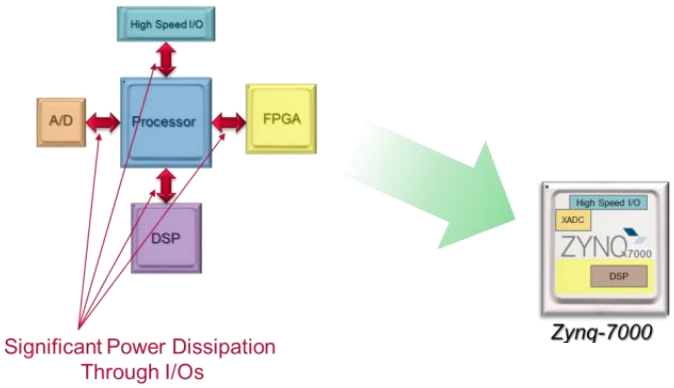
Performance Tradeoffs



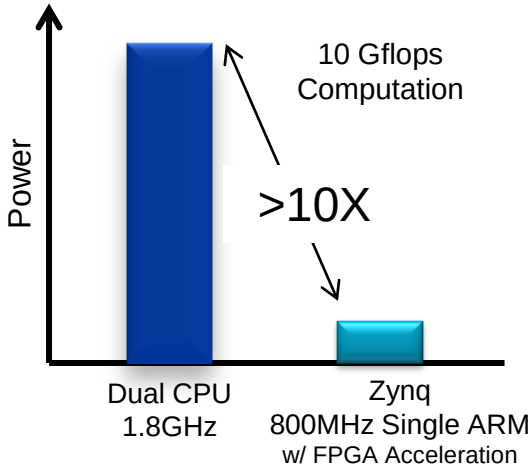
- **Integrated, feature-rich, or advanced HMIs greatly benefit from hardware acceleration**
- **Zynq-7000 AP SoCs and FPGAs offer several key benefits**

Xilinx Advantage

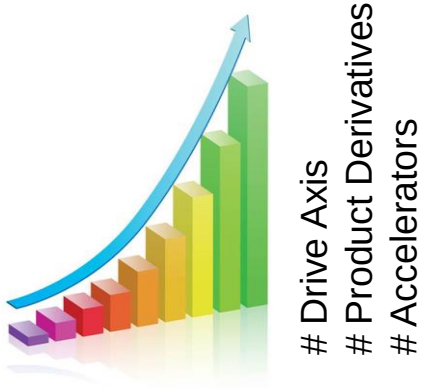
Single Chip



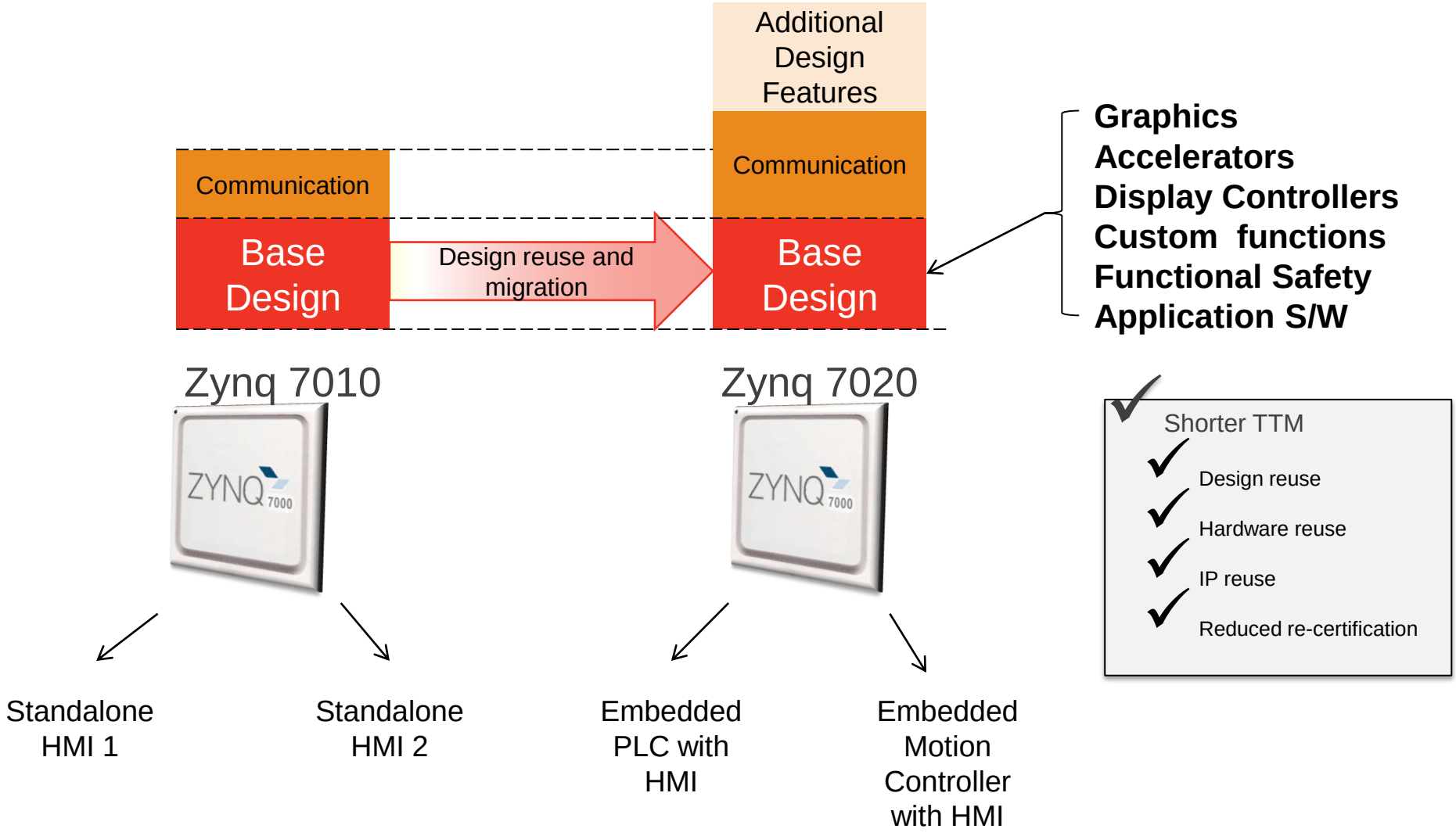
Lowest Power



Scalable



Platform = Highly Scalable Design



Examples Using the Xilinx HMI

CNC Operator Panel

- High Performance HMI for operator control and programming
- Zynq re-use across multi platforms including motor & motion control

Medical Displays

- Ultra high quality displays, up to 10 megapixel
- Supports special pixel correction, backlight and rotation algorithms

Handheld Measurement Device

- Small, low power, high reliability running on WEC7/Linux
- Long life multi platform approach

Video Conferencing

- Using Zynq AP SoC for multi input video merging & display
- High pixel bandwidth support and quality

Summary:
Solving Key Challenges with Zynq-7000 AP SoC

- **Embedded System Integration**
  - Zynq-7000 AP SoC enables single chip solution
  - Many connectivity options
  - Custom functions in high performance FPGA
- **Performance**
  - Massive parallel interface for offloading/acceleration
  - Low power
- **Productivity**
  - Large ecosystem of OS, libraries, drivers, IP
  - Xilinx tools bring it all together in a unified design environment
  - Platform-based architecture for recurring savings in time to market and engineering effort

Additional Information

HMI Graphics Support Information

- http://www.xilinx.com/applications/industrial
- http://www.logicbricks.com/Products/IP-Cores.aspx

Video Demos

- http://www.logicbricks.com/logicBRICKS-IP-Library/Video-Galleries/logicBRICKS-Demos-Xilinx-ZC702-Video-Clip.aspx
- https://www.logicbricks.com/logicBRICKS-IP-Library/Video-Galleries/logicBRICKS-Demos-MicroZed-HMI-Video-Clip.aspx
- http://www.logicbricks.com/logicBRICKS-IP-Library/Video-Galleries/logicBRICKS-2D-Graphics-Acceleration.aspx

Evaluate on Avnet MicroZed

- http://www.zedboard.org/product/microzed

Contact Xilinx

- Your FAE and Sales representative
- Jon Alexander, Marketing Manager, jona@xilinx.com

Thank You!

Appendix

HARDWARE GRAPHICS ACCELERATORS

Function	Product name	Partner	Devices
Multilayer Display Controller	logiCVC-ML	Xylon	Spartan-6, Zynq, Artix, Kintex
2D Graphics Accelerator	logiBITBLT	Xylon	Spartan-6, Zynq, Artix, Kintex
3D Graphics Accelerator	logi3D	Xylon	Spartan-6, Zynq, Artix, Kintex
Bitmap 2.5D Accelerator	logiBMP	Xylon	Spartan-6, Zynq, Artix, Kintex

RTOS and OS

Type	Product	Partner	Devices
OS	PetaLinux, open source, etc	Various	Zynq-7000
OS	Windows CE 7, 2013	Adeneo Embedded	Zynq-7000
OS	Android	iVeia	Zynq-7000
RTOS	QNX	Adeneo Embedded	Zynq-7000
RTOS	QNX	QNX Software Systems	Zynq-7000
RTOS	VxWorks	Wind River	Zynq-7000
RTOS	ThreadX	Express Logic	Zynq-7000

LIBRARIES APIs

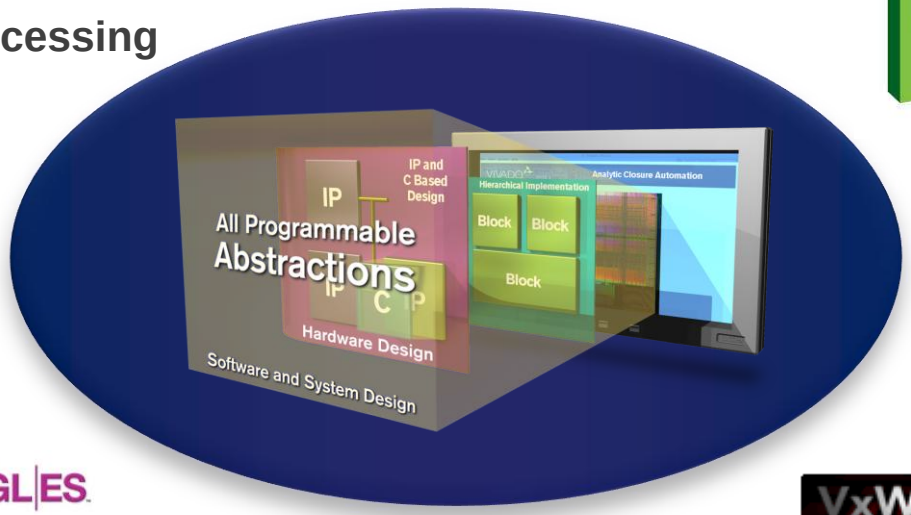
Type	Product	Partner
Software Library	DirectFB	Xylon
Application Framework	Qt	Xylon
API	DirectX	Xylon
API	Windows GDI	Xylon
API	QNX Screen	Xylon
API	OpenGL ES 1.1	Xylon

Low-End Portfolio Maximum Capacity Comparison

	SPARTAN 6	ARTIX 7	ZYNQ Z-7010/15/20
Processing Core	--	--	Dual ARM Cortex-A9 MPCore
Processor Unit Frequency	--	--	866 MHz
Logic Cells	150K	215K	85K
Block RAM	4.8 Mb	13 Mb	5.6 Mb
DSP Slices	180	740	220
DSP Performance (symmetric FIR)	140 GMACS	929 GMACS	276 GMACS
Transceiver Count	8	16	4
Transceiver Speed	3.125 Gb/s	6.6 Gb/s	6.6 Gb/s (7Z015)
Transceiver Bandwidth (full duplex)	50 Gb/s	211 Gb/s	53 Gb/s (7Z015)
Memory Interface (DDR3)	800 Mb/s	1,066 Mb/s	1,066 Mb/s
PCI Express Interface	Gen1x1	Gen2x4	Gen2x4 (7Z015)
Configuration AES	Yes	Yes	Yes
Agile Mixed Signal (AMS) / XDAC	--	Yes	Yes
FPGA I/O Pins	576	500	200
FPGA I/O Voltage	1.2V, 1.5V, 1.8V, 2.5V, 3.3V	1.2V,1.35V,1.5V, 1.8V, 2.5V, 3.3V	1.2V,1.35V, 1.5V, 1.8V, 2.5V, 3.3V

Productivity: Design Tools and IP

- **Xilinx Tools Bring Hardware and Software Design Together**
- **Large Ecosystem for Libraries, OS, IP**
- **Xilinx-Only IP for Graphics Processing**
  - Don't reinvent the wheel



DirectFB

QNX

Graphics Libraries

Qt

µC/OS

eCos

OpenGL|ES

OpenGL ES 1.1

VxWorks

INTEGRITY

Windows Embedded Compact 7

freeRTOS