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PAC (Programmable Automation Controllers)

- A Practical Example of **ICPDAS**
Embedded Solutions



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Agenda :

- What is Embedded System
- The **ICP DAS** Embedded Solutions
- What is **PAC**
- To Implement **ICP DAS PACs**
- **Q & A**



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- To Implement **ICP DAS PACs**
- **Q & A**

What is Embedded System?

- *W. Wolf : “Any sort of device which includes a programmable computer but itself is **not** intended to be a **general purpose** computer.*
- *A combination of computer hardware and software, and perhaps additional mechanical or other parts, designed to **perform a dedicated function**.*
- *Estimated 5 billion embedded processors and **94% share of processor market** worldwide*



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HMI



Military

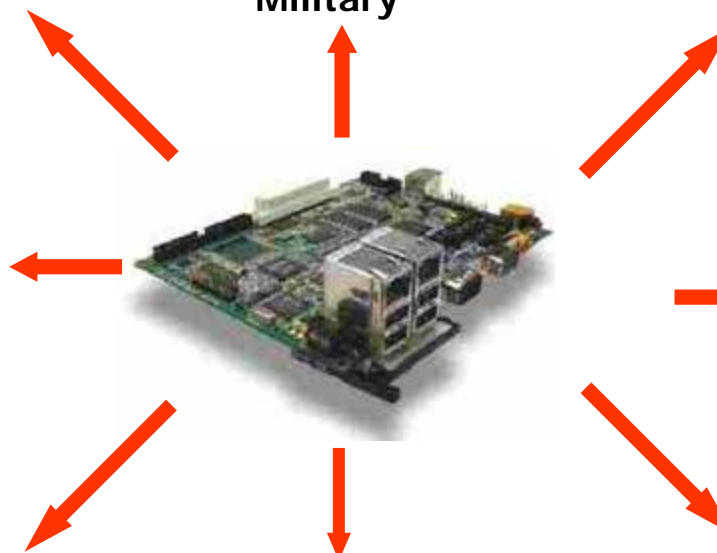
Everywhere!



Point Of Info



Car Entertainment



Barcode scanner



Transaction



Telemetric





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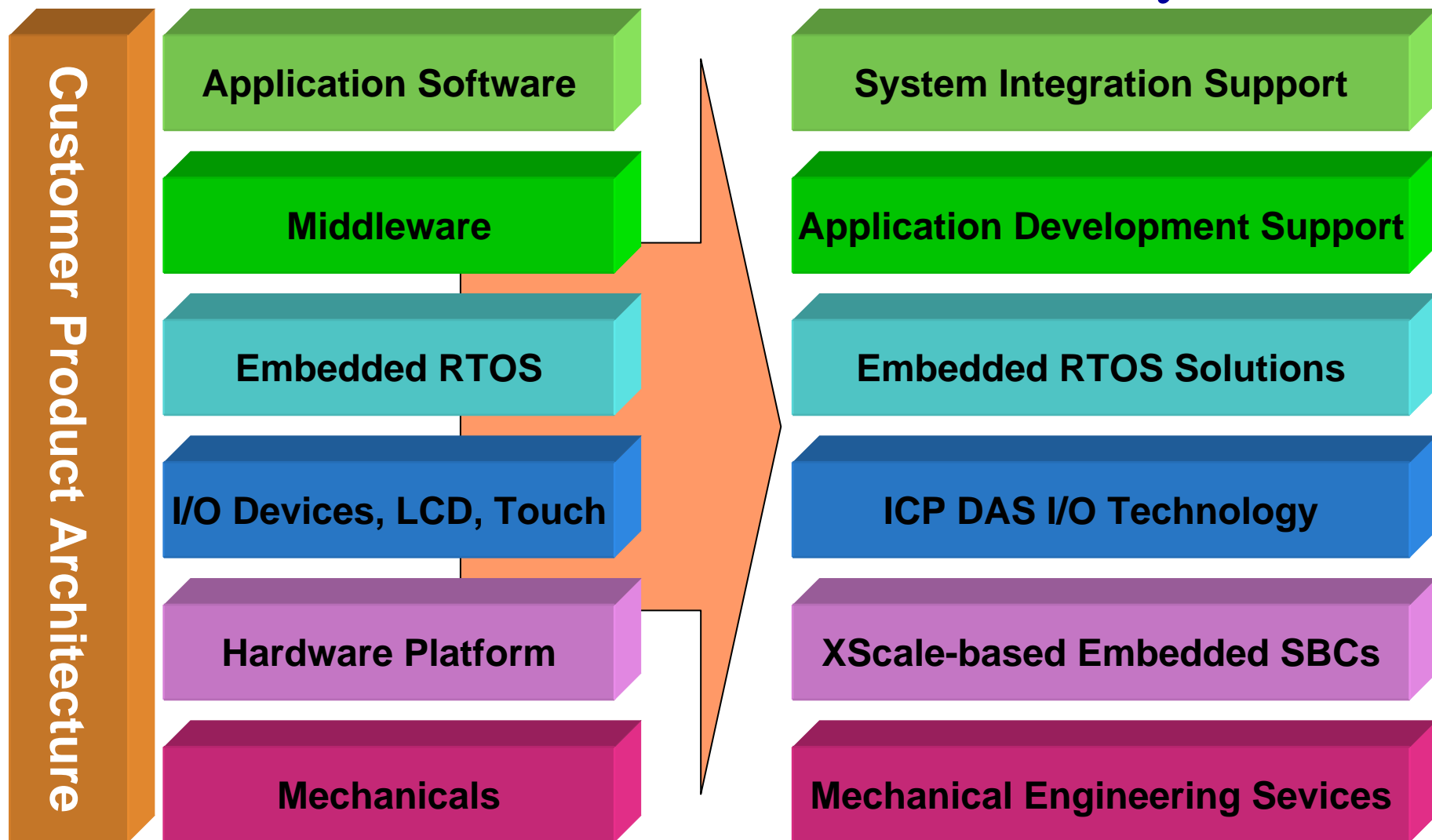


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ICP DAS total solutions for embedded systems





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ICP DAS total solutions for embedded systems

System Integration Support

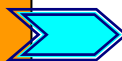
Application Development Support

Embedded RTOS Solutions

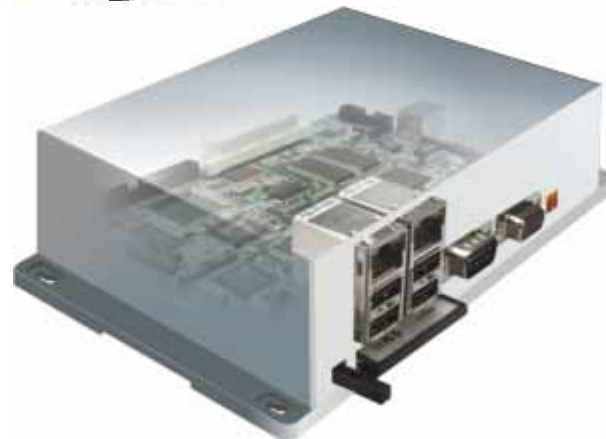
ICP DAS I/O Technology

XScale-based Embedded SBCs

Mechanical Engineering Services



◆ Best-fit Standard Chassis



◆ Customization Design



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ICP DAS total solutions for embedded systems

System Integration Support

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ICP DAS I/O Technology

XScale-based Embedded SBCs

Mechanical Engineering Services

- ◆ **3.5"** or **PC104** form factor industrial embedded SBCs designed for harsh environments.



intel.
XScale™

- ◆ NuWa series are now available !
- ◆ **OEM/DOM** are welcome



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Why Intel XScale

Intel® PXA255
Processor
with Intel XScale®
Technology





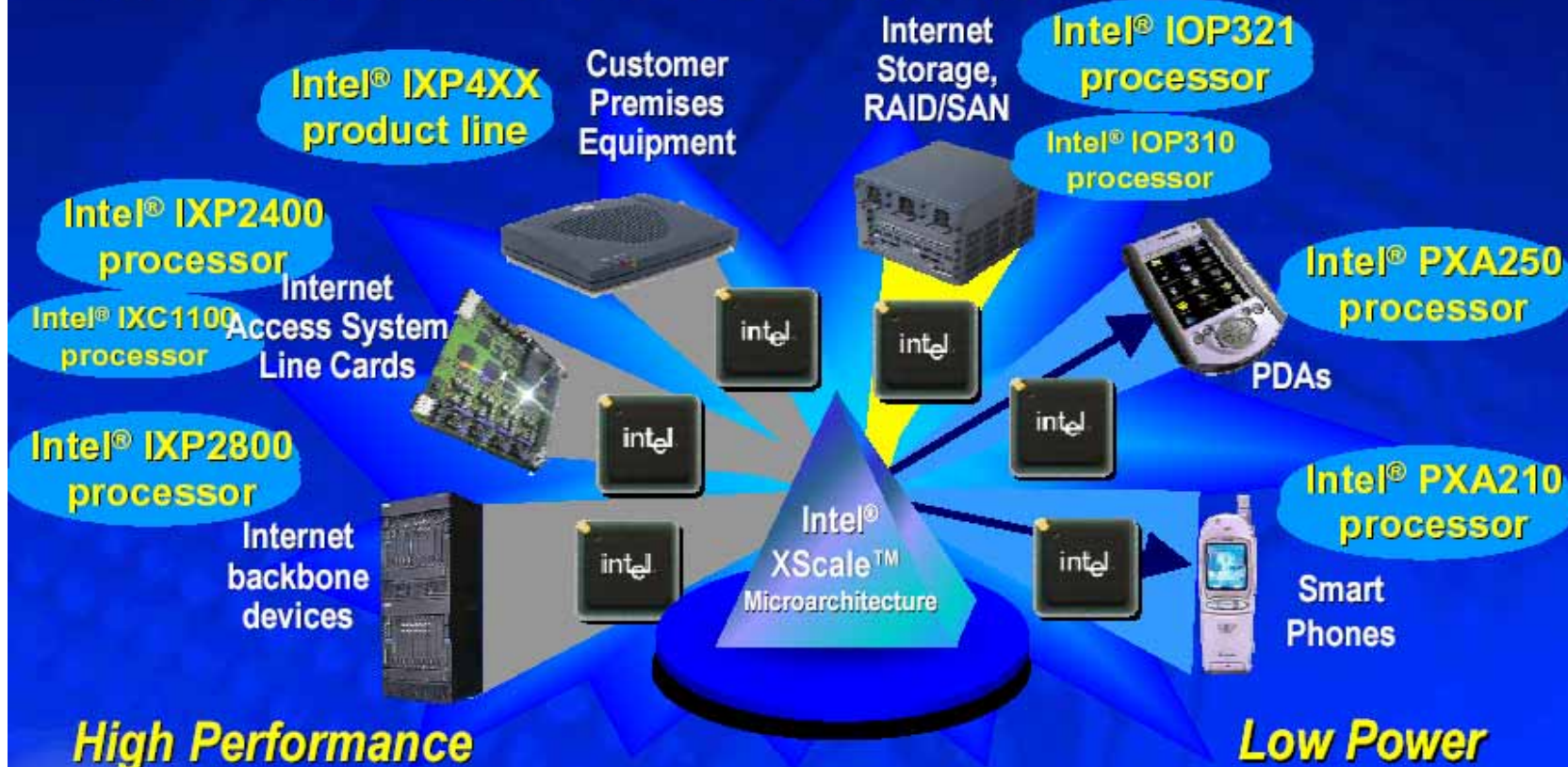
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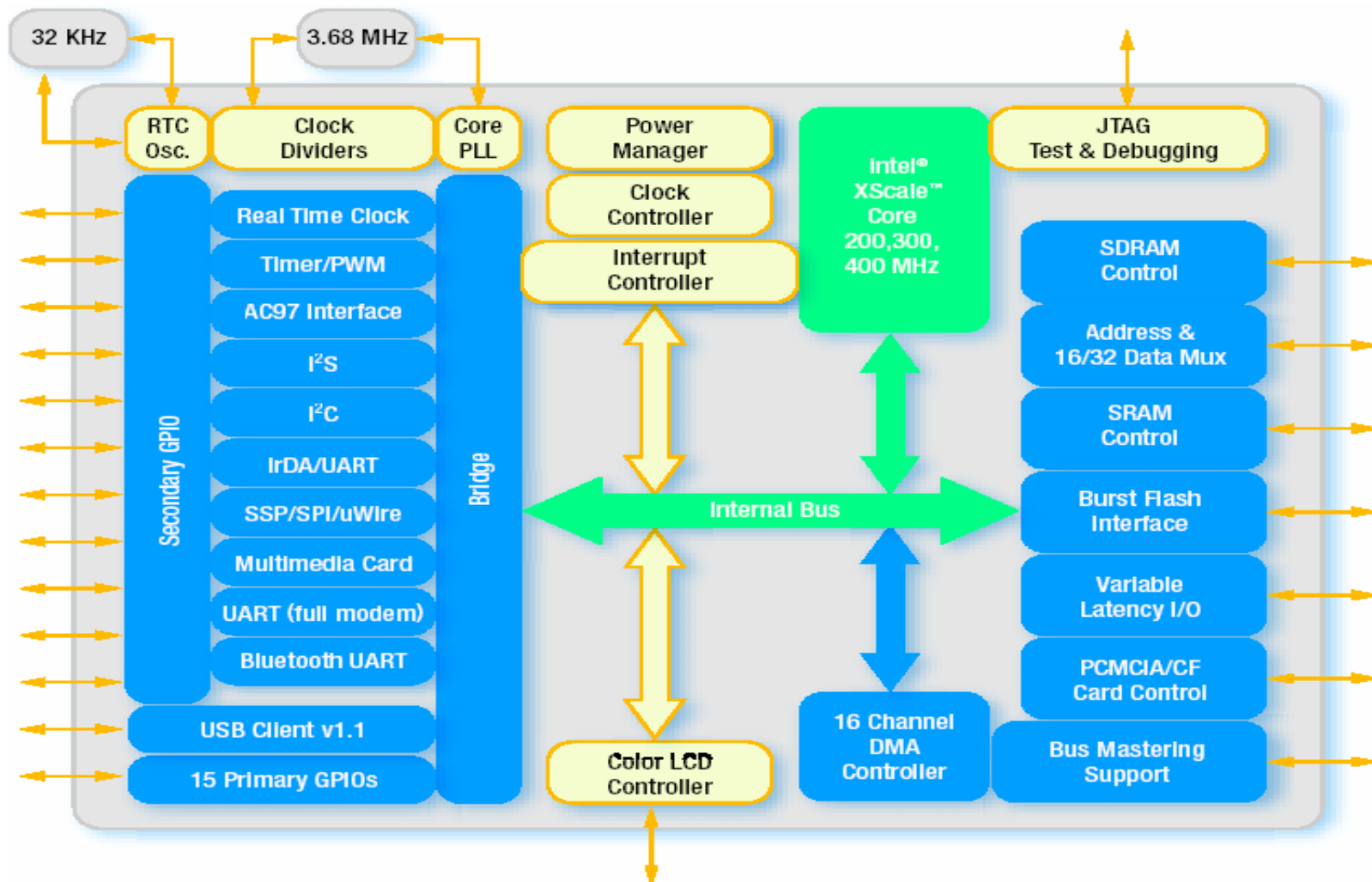
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Why Intel XScale

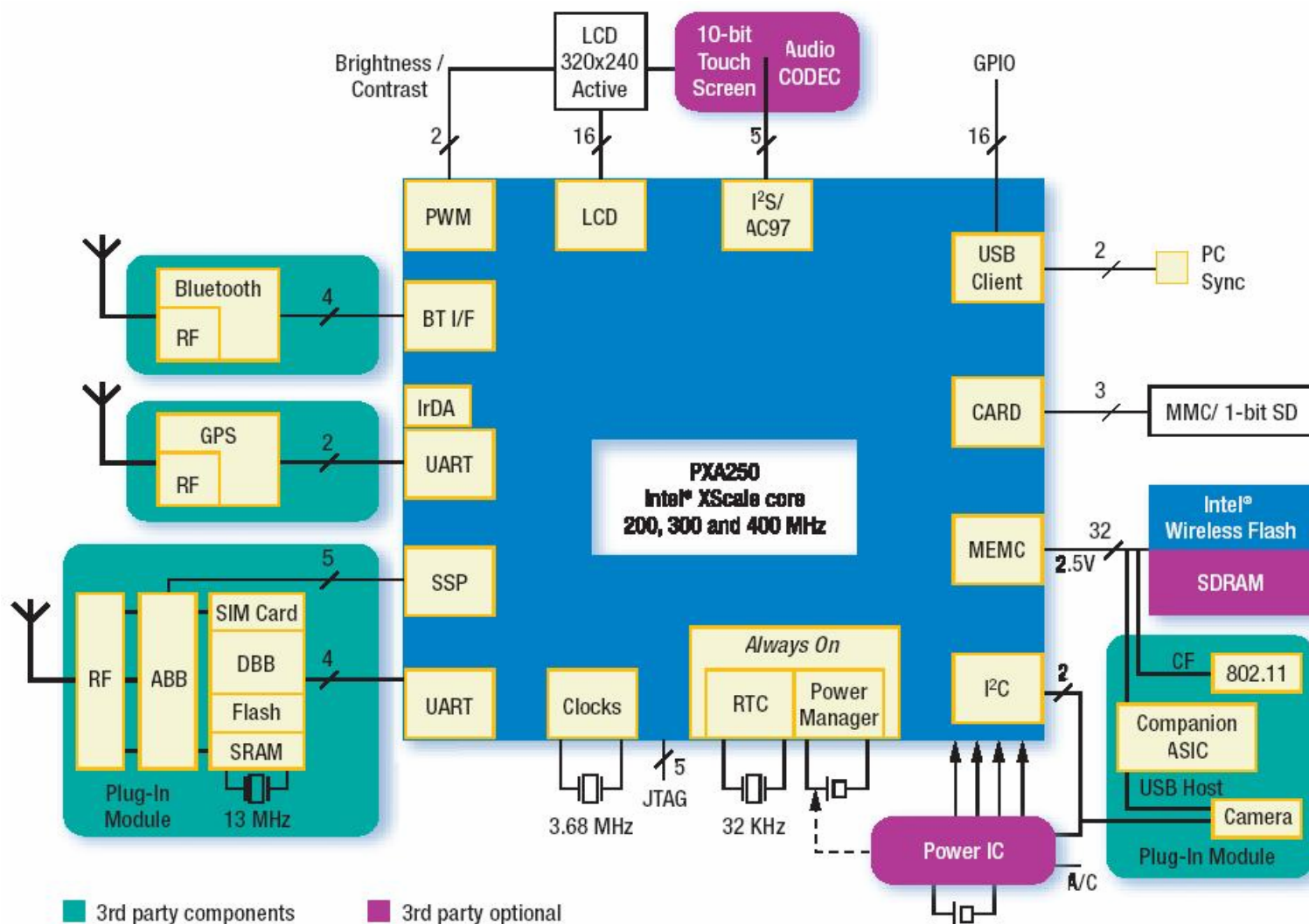
Delivering Intel® XScale™ Microarchitecture Solutions



Intel PXA255 Function Block



An Intel XScale Application Device : Wireless PDA





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ICP DAS NuWa series industrial XScale SBCs

– *3.5" FDD space SBCs*

- NuWa-470

Additional industrial solutions and field bus control.

- NuWa-450

Powerful SBC for diversify applications

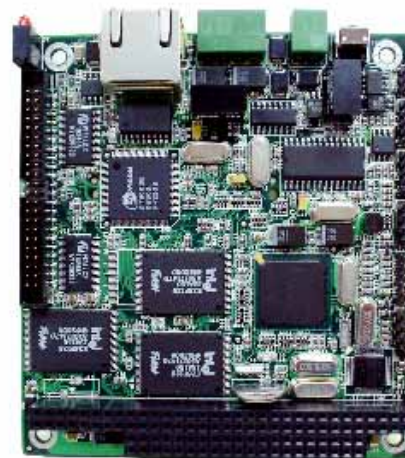
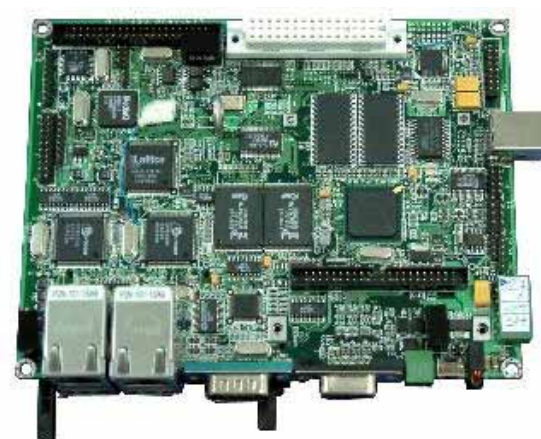
- NuWa-430

Cost-effective SBC

– *PC104 SBC*

- NuWa-104M

PC104 form factor and PC104 I/O connector compliant





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Hardware Specifications



Main Features :

- ✓ CPU : Intel PXA255 400Mhz
- ✓ Flash : 32Mbytes + 8Mbytes
- ✓ SDRAM : 64Mbytes
- ✓ SRAM, EEPROM
- ✓ CompactFlash/PCMCIA/MMC/SD interfaces
- ✓ Hardware ID, RTC, WDT, JTAG
- ✓ Reset button, Power LED

Peripherals :

- ✓ LCD interface : TTL/LVDS, 640 x 480 16bpp
- ✓ VGA output : 1024 x 768 16bpp
- ✓ Touch : 4/8 wire
- ✓ USB host x 2/4, USB client x 1
- ✓ 10/100M Ethernet : x 1/2
- ✓ CAN interface x 1
- ✓ Serial :
 - RS-232 / RS-485 : x 1
 - Tx/Rx only : 3
- ✓ Audio : Line in / Line out / Mic
- ✓ BlueTooth
- ✓ IrDA
- ✓ I-8000 / PC104 I/O Expansion slot
- ✓ Power-in : 5V/12V
- ✓ Dimension : 3.5" FDD or PC104



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NuWa Series Hardware Specifications

Model	NuWa-430	NuWa-450	NuWa-470	NuWa-104M
Processor	PXA255 400MHz			
Flash	(32+8)MB or DOC(option)			
SDRAM	64MB			
SRAM	N/A	N/A	512K(Battery Backup)	512K(Battery Backup)
EEPROM	N/A	N/A	128KB	128KB
Hardware ID	Hardware serial ID number			
Real Time Clock	RTC with battery			
Watch Dog Timer	CPU Built-in			
JTAG and Debug	Pin header for update firmware			
PCMCIA	N/A	✓	✓	N/A
CompactFlash	Type II x1			
MMC/SD	Pin header			
VGA port	N/A	1024 X 768 16bpp	1024 X 768 16bpp	N/A
LCD interface	TTL / STN / LVDS module, 640 x 480 16bpp			
Touch Interface	Built-in 4-wire touch controller			

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NuWa Series Hardware Specifications (Cont.)

Model	NuWa-430	NuWa-450	NuWa-470	NuWa-104M
Serial ports	RS-232 x 1, RS-485 x 1			RS-232 x 1 (pin header) RS-485 x 1 (pin header)
Additional serial interface	N/A	2-wire Tx/Rx only x 3 9 pin full function x 1	2-wire Tx/Rx only x 3 9 pin full function x 1	N/A
IrDA capability	Pin header for IR module			N/A
Bluetooth	Pin header for Bluetooth module			N/A
Ethernet	[10/100] x 1	[10/100] x 1	[10/100] x 2	[10/100] x 1
CAN bus	N/A	N/A	1 (pin header)	1 (pin header)
USB Host	2	2	4	1 (pin header)
USB client	X 1 (pin header)			
Audio Codec	Pin header for Line in / Lin out / Mic			
Expansion Bus	ICP DAS I/O slot			Standard PC104 slot
Reset button	Pin header			
Power LED	Pin header			
Dimension	140mm x 110mm x 40mm (3.5" FDD space)			90mm x 95mm (PC104)
Power-in	DC 5V, optional DC 12V for LCD			
Operation Temp	-20°C ~ 70°C			



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System Integration Support

Application Development Support

Embedded RTOS Solutions

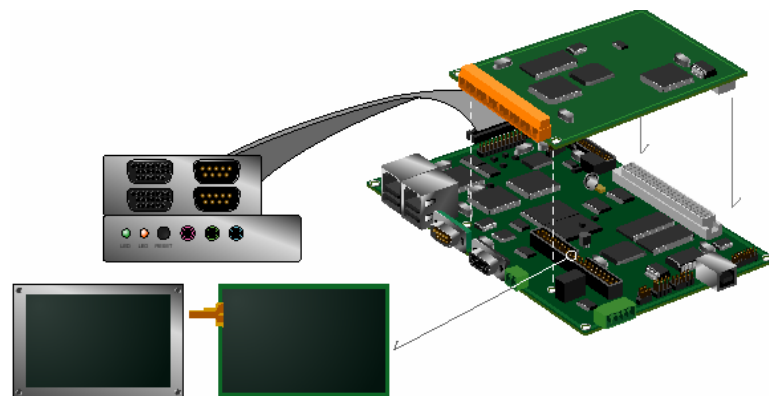
ICP DAS I/O Technology

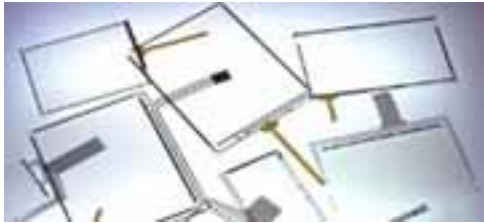


XScale-based Embedded SBCs

Mechanical Engineering Services

- ◆ LCD, Touch solutions
- ◆ Cable and connector kits
- ◆ Integration services
- ◆ Industrial PLC-style I/O boards and OEM/ODM are welcome





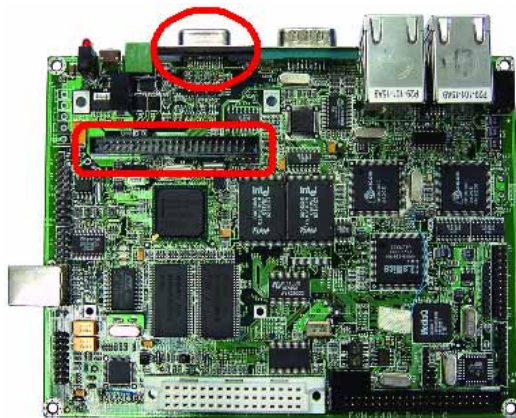
Touch Panels

- *Embedded touch controller*
- *Support any size of 4/8 wire resistant touch panel*

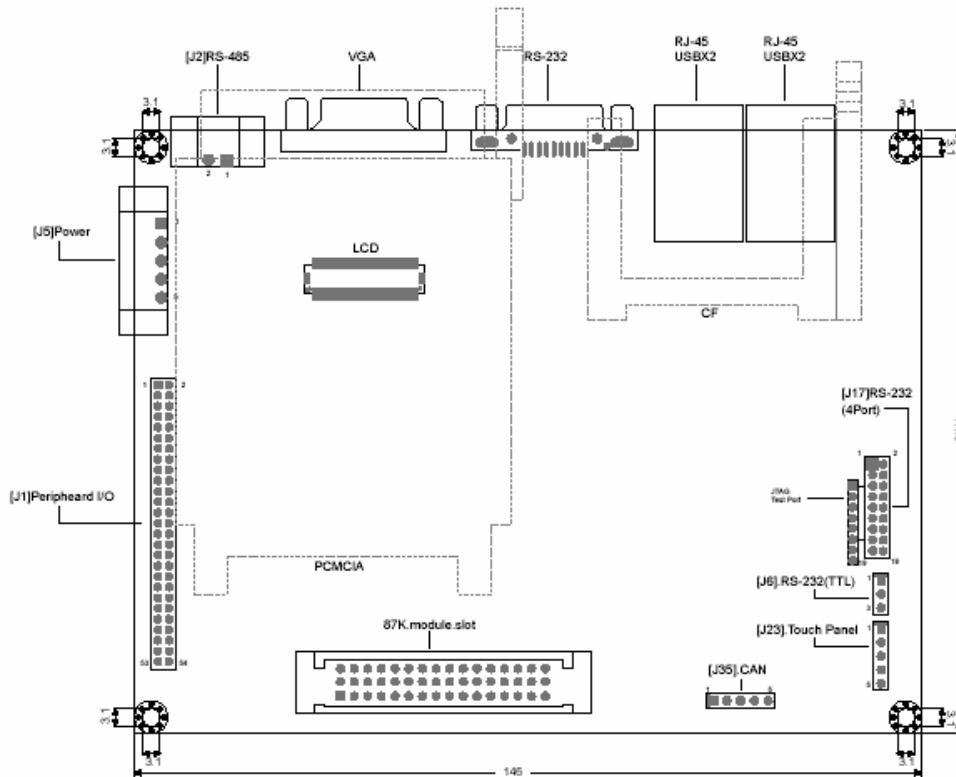


Displays

- *Support any size of LCD panels*
- *LCD panel interfaces :*



- Digital : STN/TTL/LVDS, VGA quality, 640 x 480, 16bpp
- CRT : XVGA quality, 1024 x 768, 16bpp
- *To support Digital SVGA/XVGA LCD panels :*
 - Need OEM/ODM

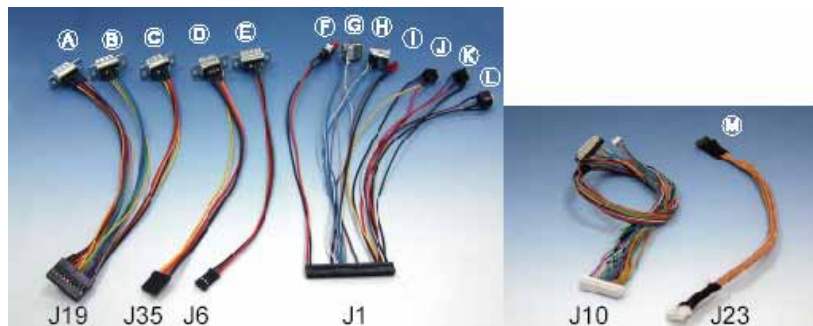


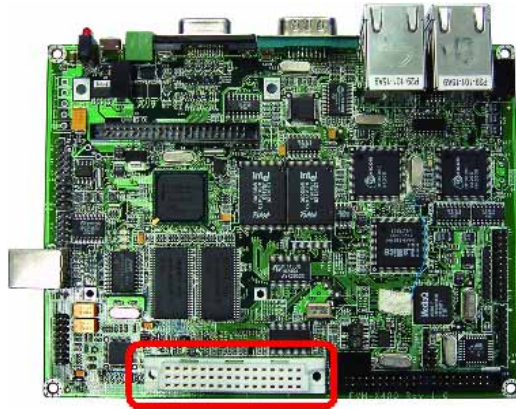
Pin headers :

- *Reset, power LED*
- *JTAG, system debug*
- *USB Client*
- *Audio*
- *SD/MMC*
- *CAN*
- *Additional serial*

Cable kits

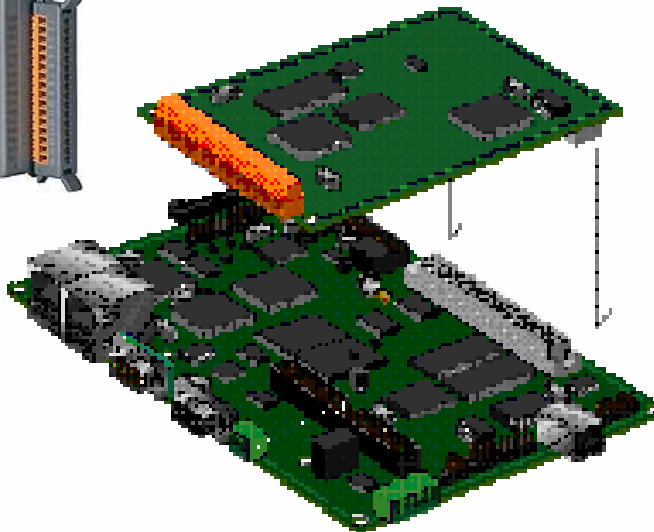
- *LCD*
- *Touch*
- *Cables and connectors for pin headers*





I/O Interfaces

- *ICP DAS I-8000 slot interface*
- *PC 104 interface*

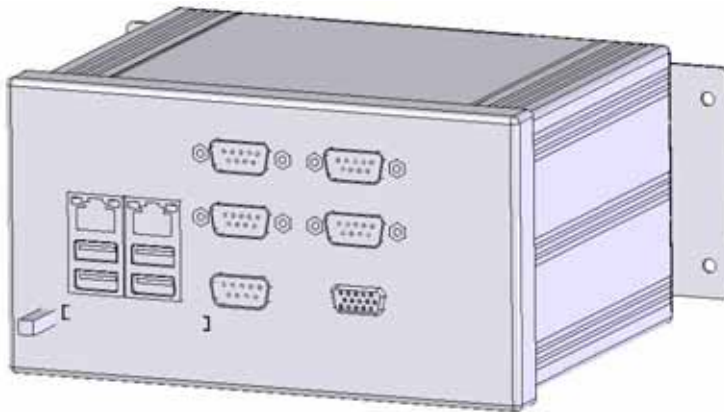


I/O Modules

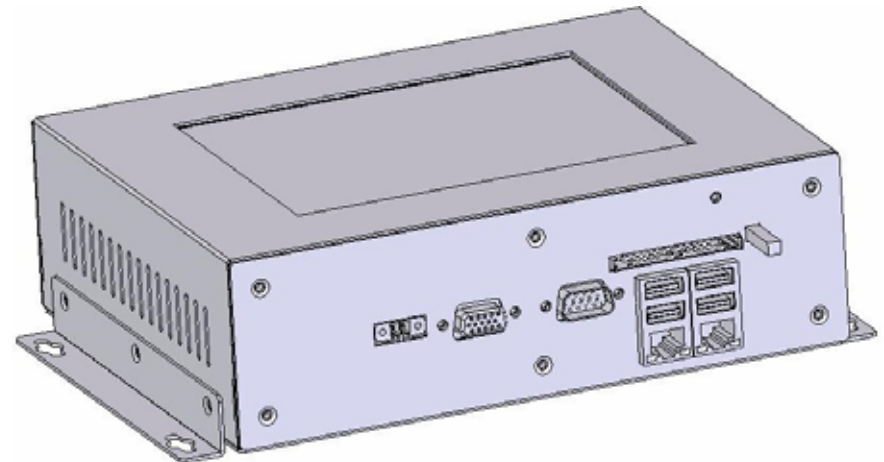
- *Support all I-8000/I-87K series I/O modules*
- *OEM/ODM*

Derived ICP DAS products :

Hero series embedded IPCs and HMIs



Embedded IPC



Industrial HMI



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ICP DAS total solutions for embedded systems

System Integration Support

Application Development Support

Embedded RTOS Solutions

ICP DAS I/O Technology

XScale-based Embedded SBCs

Mechanical Engineering Services



- ◆ Windows CE .NET
- ◆ MontaVista Linux
- ◆ Build-in standard OS image
- ◆ Customization services





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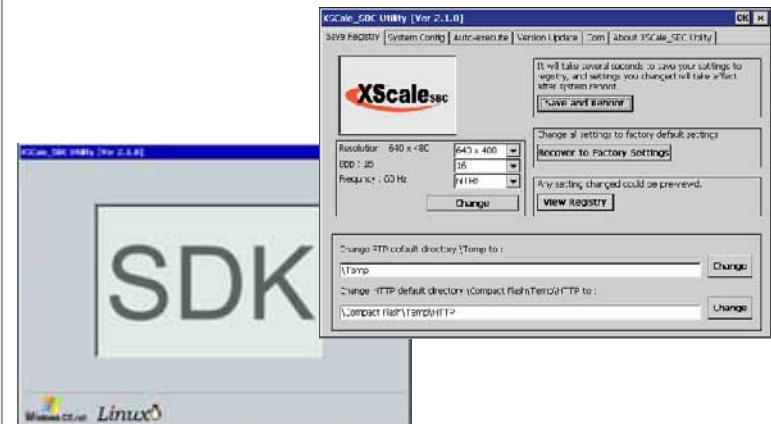
Embedded RTOS Solutions

ICP DAS I/O Technology

XScale-based Embedded SBCs

Mechanical Engineering Services

- ◆ SDK
- ◆ Utilities
- ◆ Remote Administration
- ◆ Industrial Standard protocols
- ◆ 3rd party software





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Mechanical Engineering Services

- ◆ **Developments kits**
- ◆ **BSPs for customizing OS image**
- ◆ **Training courses**





– Contents

- NuWa-470
- 10.4" or 6.4" LCD display
- 110V-240V Power
- Cables kits and speaker
- BSP
- User Manual

Development Kits for :

- *Demo and evaluate hardware*
- *Developing Applications*
- *Customizing OS image*

Integration Services :

- *LCD driver integration*
- *OS image customization*

Training Courses:

- *ICP DAS BSP for OS developers*
- *ICP DAS SDK for application developers*



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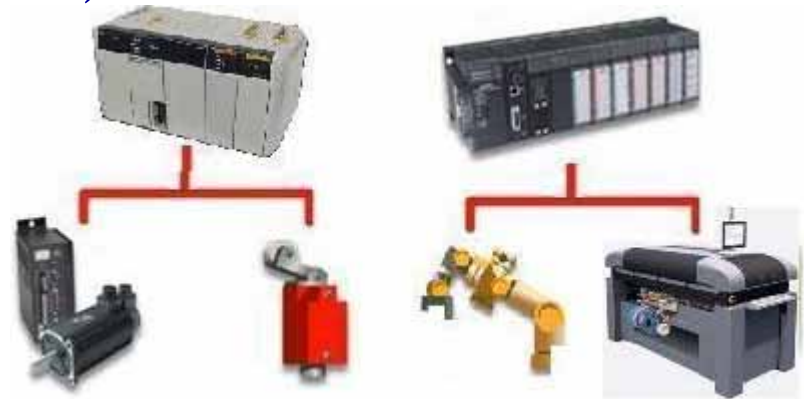
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- What is **PAC**
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- **Q & A**

The Traditional PLC (Programmable Logic Controllers)

- *PLCs have been the control solution for more than two decades and still very much alive!*
- *But, PLCs are grounded in proprietary architectures*
- *Limitations:*

- Proprietary architectures, lacks of system resources and fancy peripherals
- Designed for Specific Applications, Different Applications require different hardware and development tools
- Hard to maintain, migrate, and upgrade
- Big challenge to enable interoperability and information exchange



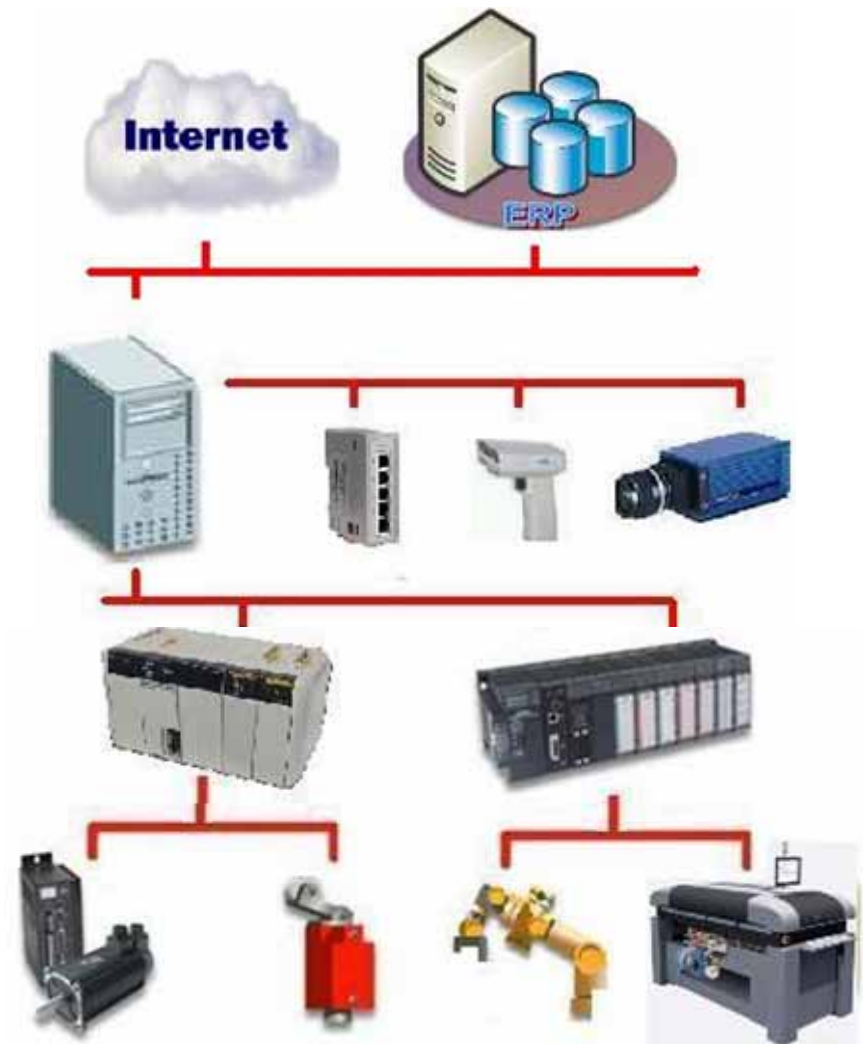
Today's Factory Architecture

– *The Hybrid Solution*

- In the 80s and 90s, engineers used industrial PCs to provide advanced functionality.

– *Limitations:*

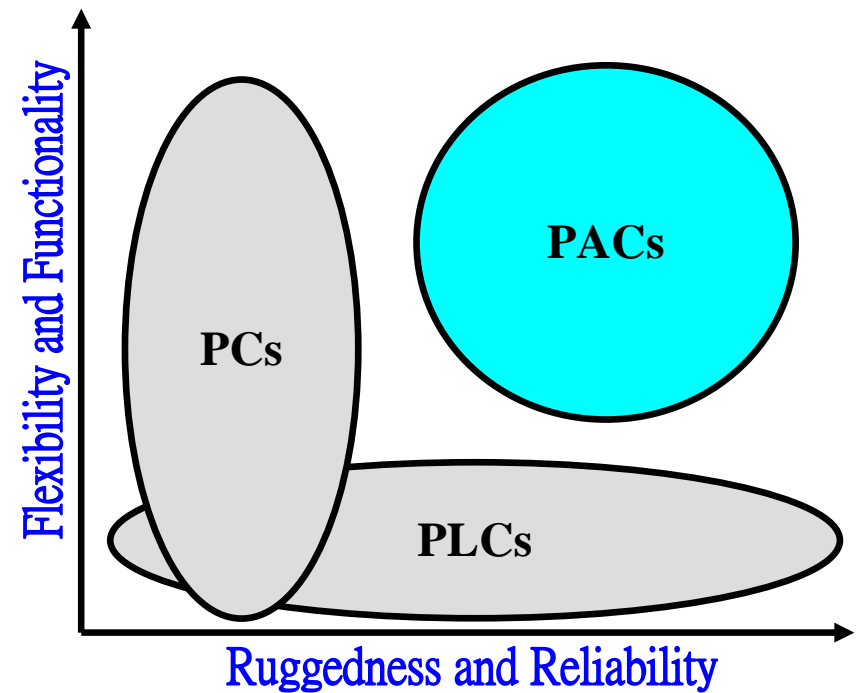
- Poor quality and endurance in industrial harsh environment
- Desktop OSs are unpredictable
- Difficult to construct, troubleshoot and maintain
- Not an integral whole



PAC (Programmable Automation Controllers)

- The Evolutions in Control

- *PAC is the new term coined by **ARC** to define the next generation of industrial automation controllers.*
- *A PAC combines the functionality of a **PC** and reliability of a **PLC***



Products of PACs

– *The ICP DAS PACs :*

– *The other PAC vendors*





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$$\text{PAC} = \text{PLC} + \text{IPC}$$

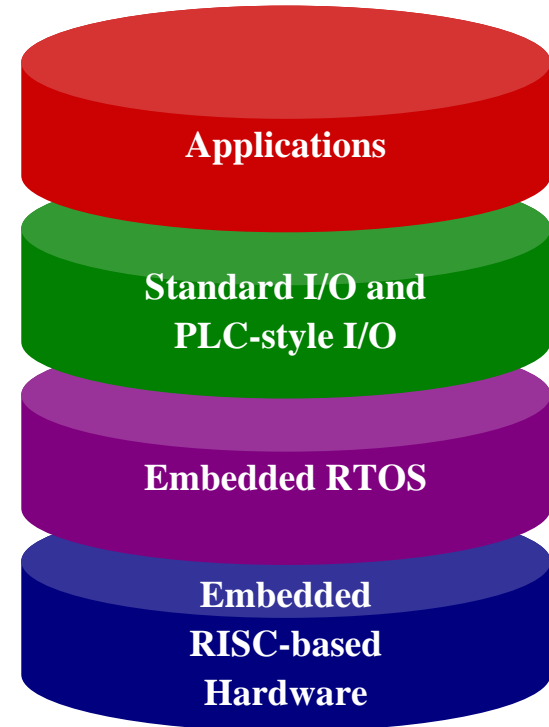
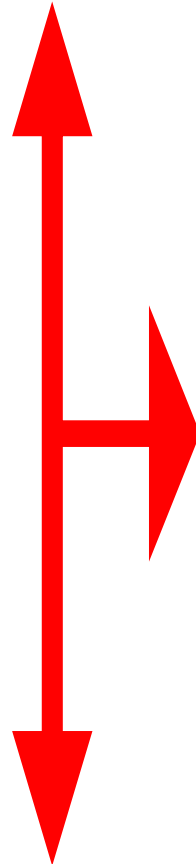
PAC Architecture



Ruggedness and Reliability



Flexibility and Functionality



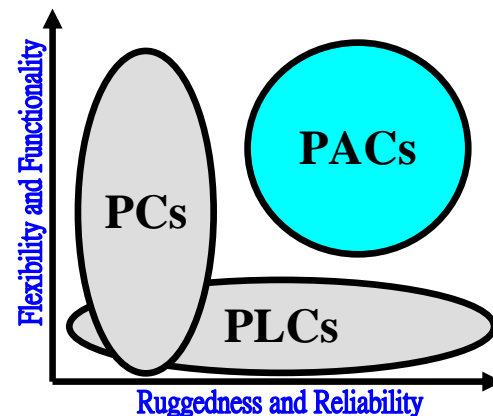
$$\text{PAC} = \text{PLC} + \text{IPC}$$

– To provide advantages of PLCs

- Ruggedness, reliability, and survivability
- RISC processor
- Industry-grade components
- Highly protection

– To prevent disadvantages of PLCs

- ICP PACs make extensive use of COTS (Commercial Off The Shelf) products and technologies.
- Availability, maintainability, and easy to upgrade



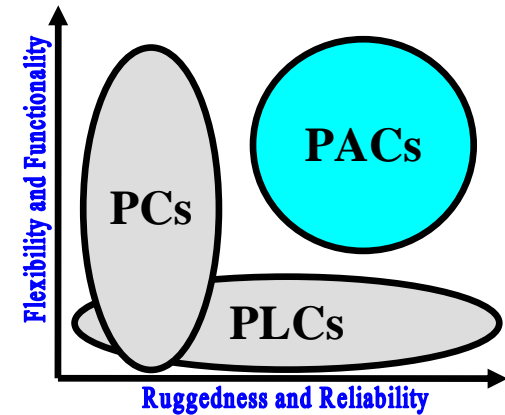
$$\text{PAC} = \text{PLC} + \text{IPC}$$

– To provide advantages of IPCs

- Standard I/O and peripherals
- Popular RTOS
- Advanced programming languages
- Openness ,flexibility, and OEMs
- Communications to business systems

– To prevent disadvantages of IPCs

- Industrial hardware design
- Diskless and fanless
- Wide operation temperature
- Built-in embedded hard real-time OS
- Fast boot up and system recovery



PLC-Style I/O modules

- *Digital I/O*
- *Analog I/O*
- *Motion Control*
- *Counter/Frequency*
- *Multi-port serial*





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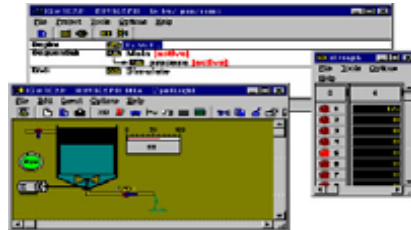
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Application Software

– *PLC Software :*

IEC-61131-3 compliant PLC Software to provide reliable scanning architecture



– *PC Software :*

Popular **hard real-time OS** to provide flexible general-purpose programming language for complex applications and mass data exchange



XML



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WinCon-8000

PLC

IPC

HMI SCADA



=



+



+

RISC CPU206MHz
EEPROM/Flash/SDRAM
Real-Time Clock
WatchdogTimer
Hardware Unique S/N

Reset Key

USB
Keyboard
Mouse

Parallel Bus
I/O Expansion Slot

LED Indicator

DC Power In

LED Indicator

Ethernet Port

VGA

Compact Flash

COM Port
(RS232)

COM Port
(RS485)

Analog Input / Analog output
Current Loop
Digital Input / Digital output
Relay Output
Open Collector Output
Counter / Frequency

Operating Temp.: -25 C ~ +75 C



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- **Q & A and Thanks!**