



## **Embedded Component and Tool Categories and Products**

### ***An introduction to reusable assets***

Dear embedded marketplace reader:

This document is an attempt to capture all components, tools, and services used by developers in the embedded marketplace. It is an ambitious effort to start a new standard that the embedded industry can use and reuse as a template for product development and as a means to seek out partnerships with a combination of component and tool vendors.

### **Uses for this standardized list**

ECI uses this standard list to form the structure for its *Embedded Components and Tools Marketplace*™. Yet, there are many additional uses for a list of all reusable assets for the embedded marketplace. Some uses might include:

- Check list for designers who wish to take advantage of a component architectural view
- Roadmap to partnership development between engineering and marketing/sales efforts
- Validation efforts between multiple component's and vendors
- Internet web service offering access to features related to this list
- Incorporation of other lists maintained by others
- Tools for automating this list as an open standard

### **An example**

An embedded device development example: There exist many commercial-off-the-shelf (COTS) components, development tools, and services that an embedded device manufacture could purchase rather than build on their own for their next project. It does not matter whether this company plans to build a new or updated device. And it does not matter which of many diverse markets such as a medical instrument, communication server, or entertainment product, etc... this device will be used because many of these COTS components are not market specific.

The determination by a device manufacturer to build their own component or purchase a COTS component comes down to a combination of many issues. By seeking out available components, tools, and servers offered by experts in their fields, a device manufacturer may shorten their development time, decrease risk, save money, and beat their competitor to market. Yet managing vendor relationships and their related components and tools also has risk and may not save time or money.

Initial draft for a comprehensive components and tools list as a standard for the embedded marketplace.

Some of the issues to consider in the build vs. buy decision include:

- the company's market awareness and availability for a component,
- quality of the component and its interfaces,
- quality of the relationship with the vendor supplying the component,
- ability to support integration of a new component into a mix of other vendors' components, where each vendor may not be aware of the impact of each others components when combined into the manufacturer's device,
- terms and conditions of how the component, tool, or service is licensed
- competitive time to market concerns,
- product revision cycle: new product vs. updated product,
- engineering expertise or existing in-house components, and
- total cost of owning this component (return on investment).

### **Concluding remarks**

ECI's mission is to help manufacturing companies and the field of available vendors work more closely together to realize the time to market and other marketing claims commercial component and tool vendors make with respect to their individual offerings. The scope of ECI's work to component and tool users, makers, and enablers includes engineering and marketing services.

I invite those who are interested in working on this standard to contact me with their proposals to participate.

Sincerely,

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## **Hardware**

### **Semiconductors and ICs**

#### **Bus**

- AMBA
- ARINC 429
- ARINC 575
- MIL\_STD-1553
- CAN bus
- Fieldbus
- Futurebus
- GPIB (IEEE 488)
- Graphics Bus
  - AGP
- Host Parallel Port (IEEE 1284)
- H.110
- I2C
- ISA
- EISA
- GIO
- PCI
  - Hot swap
- cPCI
- PCI Express
- PMC
- P/104
- P/104+
- EBX
- PCMCIA
- RACEway
- RapidIO
- S-Bus
- S/T-Bus
- SCSI
- Switch Fabric
  - StarFabric
  - InfiniBand
- VXI
- VMEbus
  - Master
  - Slave
- VITA-19 BusNet

## **Bridge**

- South (of processor typically for I/O)
- North (of processor typically for memory)
- PCI to PCI
- PCI to/from ISA
- PCI to/from VMEbus

## **Forward Error Correction**

- Interleaver/Deinterleaver
- Reed-Solomon
- Trellis
- Viterbi

## **Timing**

- Watchdog
- Event
- PLL

## **Processor**

- Microprocessor/Controller/SoC
  - 4-bit MCUs/MPUs
  - 8-bit MCUs/MPUs
    - Atmel
  - 16-bit MCUs/MPUs
    - MIPS Cores
      - LSI Logic
      - MIPS16 or TinyRISC
  - 32-bit MCUs/MPUs
    - 68K
      - 683xx
      - CPU32
      - 68040
      - 68030
    - i960
    - ARM cores
      - ARM7
      - ARM9
      - ARM9E
      - ARM10
      - ARM11
      - StrongARM
      - XScale
    - Coldfire
    - M-Core
    - IA32 (x86)

- Intel
  - 8086
  - 80286
  - 80386
  - 80486
  - Pentium
  - Pentium II
  - Pentium 4
- ST Micro
  - STPC
- National Semiconductor
  - 486SXF SoC
- AMD
  - Microcontroller
  - k6
- PowerPC
  - IBM
    - 401
    - 403
  - Freescale
    - 603
    - 604
    - 740
    - 821
    - 823
    - 860
    - 7400
  - Honeywell
    - RAD Hardend PowerPC
- SPARC cores
  - Futjitsu Micro
    - SPARClite
  - Sun Micro
    - UltraSparc
    - SPARC IIep
- JAVA
  - Processor
  - Co-processor
- MIPS32 cores
  - IDT
    - R5000
  - QED
    - RM5260
    - RM5230
  - Toshiba
  - LSI Logic

Initial draft for a comprehensive components and tools list as a standard for the embedded marketplace.

- MIPS
  - 4Kc
  - QuickLogic
    - 4Kc core + SoC
- SH
  - Hitachi
    - SuperH
    - SH1
    - SH2
    - SH3
    - SH4
    - SH5
  - Proprietary
    - NEC
      - V800
- 64-bit MCUs/MPUs
  - MIPS64 cores
    - Toshiba
      - CMOS Systems
  - SPARC
- Digital Signal Processor
  - Media
    - MPEG
    - Audio
      - TI
        - C6X
    - Graphic
  - Math
    - Floating point
    - FFT
    - Vector processing
  - Radio
    - GSM
- Network Processor
  - Vitesse
  - Intel
- Reconfigurable processor
  - Chameleon
  - Tensilica
  - ARC
  - Equator
- Security Processor

## **Microprocessor/Microcontroller Peripherals**

- on-Chip instrumentation
  - OCI Block

- JTAG
- BDM
- N-Wire
- Timing
  - Real-Time Clock
- Controller
  - Interrupt Controller
    - Programmable Interrupt Controller
- I2C
- Memory Controller
  - DMA
  - MMU
  - Cache memory controller
  - Graphics memory controller
  - Non-Volatile memory controller
  - Dynamic memory controller
  - Dual ported dynamic memory controller
- Memory
  - Flash
    - NAND
    - NOR
  - EPROM
  - EEPROM
  - PROM
  - ROM
  - DRAM
  - SRAM
  - Graphics Memory
  - Cache memory

## **Message**

- I2O

## **Design Specific Logic**

- Custom ASIC
- Application Specific Standard Products (ASSP)
  - Consumer chip sets
    - Digital Terrestrial Tuner/ Front End systems
    - Digital Satellite Tuner / Front End systems
    - Analog Terrestrial and Cable Tuner systems
    - Modulators/ Mixers / Amplifiers
  - Telecommunication
    - PBX Transceivers
    - PCM Transceivers
  - Gateway
    - Home

- Multimedia
- Security
- LAN
  - Wired
  - wireless
- Communication
  - Cellular
    - Base station
  - GPS
  - Cordless
  - Modem
- Voice chip sets
  - VoIP
- Graphic chip sets
  - TV
  - Interactive TV
- SoC
  - AMBA Bus
- Reconfigurable logic
  - PLD
  - CPLD
  - FPGA
  - FPGA with ASIC
  - Megacell Functions (CPU Cores, etc...)
- Full Custom ICs

### **Data Communication (Asynchronous)**

- Analog to Digital (A/D)
- Digital to Analog (D/A)
- Parallel I/O
- Infrared I/O
  - IrDA
- ID
  - RFID
  - Electronic Tag
- PCM Interface Controller
- Serial I/O
  - RS232 UART
  - RS422 UART
  - V.35/Bell
- Intelligent communication
  - USB
  - Firewire (IEEE 1394)
  - PCMCIA
- Ethernet
  - MAC



- MII
- PHY
- FIFO
- 10 Gigabit
- 1 Gigabit
- 100 Megabit
- 10 Megabit
- Statistics Module
- END
- 10Base-T
- 100Base-X
- Ethernet Switch
  - Multilayer
    - Agere
    - MUSIC Semiconductor
- Shared memory
  - FDDI
  - FibreXpress
  - SCRAMNet
- Mouse
- Trackball
- Keyboard
- Programmable Communication Controllers
  - QUICC
  - AltiVec
- Wireless
  - Bluetooth
  - 802.11a
  - 802.11b
  - 802.11g

### **Telecommunication (time slot)**

- SLIC
- CODEC
  - Audio
  - Speech
  - Video
- DTMF
- Wide Area Network WAN
  - HSSI Adaptors
  - T1 Interface/framer
  - E1 Interface/framer
  - J1 Interface/framer
  - E3 Interface/framer
  - DS3 Interface/framer
  - Sonet Interface

- X.25
- HDLC
- SDLC
- ATM
- Frame Relay
- SS7
- Bisync
- Modem
- Cable
  - DOCSIS
- DSL
  - ADSL
  - XDSL
  - VDSL
- ISDN

## **Display**

- LCD controller
- CRT controller
- VGA controller
- Touch Screen controller
- Graphics Acceleration
  - NVIDIA
  - ATI

## **Sound**

- FM

## **Security**

- Encryption
- Decryption
- Manchester
- Smart Card
- IPSec
- IKE

## **Storage**

- Floppy disk
- ATA (IDE) Hard Disk
- SCSI
- RLL

## **Sensor**

- Video
- Air flow

- Temperature
- Light
- Optical Pulse Encoder
- Current
- Voltage
- Pressure
- Sound
- Magnetic
  - HALL Effect

## **Power**

- linear
- switching
- variable
- single
- dual
- current regulation
- voltage regulation
- Low Power Silicon
  - Example Companies
    - Virtual Silicon
    - InHand Electronics
    - National Semiconductor
    - Virage Logic Corp
    - Artisan Components

## **Standard Logic ICs**

## **RF/Microwave**

## **Mixed-Signal**

## **Amplifiers**

- Op Amps

## **PC Boards**

### **COTS hardware**

- Bus and Microprocessor/Microcontroller Specific System board
- Bus Specific I/O board
  - Network
    - Ethernet
    - FDDI
  - Telecommunication
    - Call Routing
    - Call Logging

Initial draft for a comprehensive components and tools list as a standard for the embedded marketplace.

- Call Monitoring
- Private Communications Exchange
- Unified Communications
- Quality Management
- FAX
- FAX over IP
- Serial
- Counter
- A/D
- D/A
- Video Capture
- Tuner
- AM
- FM
- Bus and Microprocessor/Microcontroller Specific Slave Board
- Bus Specific Security
  - Encryption Accelerator
  - crypto accelerator
- Bus Specific Storage Board
- Form Factor
- MBX
- ADS
- EBX
- Motherboard

### **Reference designs**

- Bus and Microprocessor/Microcontroller specific reference design
- Bus and I/O specific reference design

### **Power supplies**

- Bus specific switching
- Bus specific linear

### **Sub-Assemblies**

- Chassis
- Backplane
  - VME
    - 3U
    - 6U
    - 9U
  - PCI
  - CPCI
  - VXI

## **Global Positioning System (GPS)**

### **Military/Aerospace**

### **Set-top Box**

### **Residential (home) Gateways**

### **Switch**

### **Printing platform**

### **Television**

- Interactive TVs
- HDTV

## **Working Devices**

### **Test products**

- Run control
  - Pods
    - JTAG
    - BDM
    - N-Wire
- In-Circuit Emulator (ICE)
  - Processor Pods
- PROM ICE
- Logic Analyzer
- Oscilloscope
- POST Analyzer
- Flash Card
- Automated System Test
  - Functional
  - Regression
- Network Performance Analyzer

### **Development Products**

- EPROM Programmer
- Emulation environment

### **End User Products**

- Transportation
  - Automobile
    - Under Carriage
    - Telematics

- Entertainment
- Space Station
- Airplane Systems
  - Avionics
- Marine
- Military/Government
  - Communications
  - Rockets, Missiles
  - Sensing, Radar, Sonar
  - Weapons systems
  - Vehicles
- Test Instruments
- Biometric Devices
- Business Devices
  - Point-of-Sale (POS)
- Network equipment
  - Hubs
  - Switches
  - Routers
  - Gateways
  - Wireless, Wired, Fiber-Optic Networks
  - LANs, WANs
- Telecommunications equipment
  - Multiplexers
  - Switches
- Consumer Devices
  - Phones, VoIP phones, Cell phones, pagers
  - Cameras
    - Shutter Controller
    - Digital Camera
    - Video Camera
  - Smart Phones
- Entertainment
  - Game Consoles
  - Set-top Boxes
  - TV
  - HDTV
  - Music Managers
  - Multimedia applications
  - Radio Systems
  - Video Players and Recorders
  - Tape recorders
  - Web TV
- Medical Test
  - Glucose Meters
  - Blood Pressure Meter

Initial draft for a comprehensive components and tools list as a standard for the embedded marketplace.

- Photo Appliances
- PIM, PDA, handhelds
- Printer
- Storage
- Consumer Premises Equipment (CPE)
  - DSL Modem
  - Cable Modem
  - Home Gateway
- Medical Devices
  - Instruments
    - Spectrometers
    - DNA Analyzers
    - Cell Counters
    - Gas Chromatography
    - CAT Scan
    - MRI
    - X-Ray
    - EKG
    - EEG
  - Implants
    - Heart Pacer
  - Surgical
    - Laser systems
    - Patient monitor systems
- Aeronautical/Defense
  - Radar
  - Communications
  - Flight monitor and control
  - Targeting Weapons Systems
  - Body armor systems
  - Infrared detectors
- Weather
  - Measurement
  - Display
- Industrial Manufacture
  - PLC
  - Motion Controls
  - Electronic Equipment, ATE, Test and Measure
  - Fluid monitors
  - Packaging machines
  - Robotic systems

## **Software**

### **Language**

#### **Applicative**

- Basic
- C
- Pascal
- Modula
- FORTRAN
- Ada

#### **Concurrent, Distributed, and Parallel**

#### **Data-flow**

- Lisp

#### **Design**

- IDL

#### **Extensible**

#### **Macro and Assembly**

#### **Microprogramming**

#### **Nondeterministic**

#### **Nonprocedural**

- Prolog

#### **Object-Oriented**

- C++
- Java

#### **Specialized Application**

- Forth
- Postscript
- Verilog
- VHDL
- SGML
- TeX



## **Very High-Level**

- Awk
- Perl
- Rexx
- Tcl
- Python

## **Run-Time Component**

### **Board Support Package**

- Board initialization
  - Cold Start
  - Warm Start
- BIOS
  - Phoenix
- CPU initialization
- Device initialization
- RTOS initialization
- Debug initialization
- Loader initialization

### **Bus Support**

- Hot swap
- Bridge Chip library
- CAN bus controller software
- VME communication controller software
- CPCI communication controller software
- PMC communication controller software
- RACEway communication controller software
- Backplane communication

### **Distributed System Support**

- Cluster
- Client/Server
  - CIFS
  - NFS
- CORBA
  - RT-CORBA
- DCE
  - RPC
  - IDL
- DeviceCOM
- Fault Tolerant System
- GIOP
- Grid

- High Availability
- Hot Swap
- Java Distributed Services
- Microsoft .Net
- Microsoft OLE
- Microsoft DCOM
- OPC
- Parallel Processing
- Peer-to-Peer
- Publish/Subscribe
  - CGAI
  - NDDS
- SOAP

### **Market Specific solutions**

- Aerospace
  - DO-178 compliant solutions
  - IEC61508 compliant solutions
  - ARINC 653 compliant solutions
- Automotive
  - OSEK solutions
  - Mapping
  - Media Oriented Systems Transport (MOST)
  - CAN protocol
  - IDB-1394
- Consumer Applications
  - HAVI
  - Set-top
    - Interactive Information
      - iTV (US)
      - DVB-MHP (European)
      - OpenCable OCAP
      - ATSC DASE
- Video streaming
- Telephony Frameworks
  - Voice processing applications
- Personal Information Management (PIM)
  - Mobile phone smart solutions
  - Email
  - GUI
  - Remote Desktop
  - Multiple Application Manager
  - Input Device Management
  - Internet application
- Wireless mobile application frameworks
- Internet Appliance Designs

Initial draft for a comprehensive components and tools list as a standard for the embedded marketplace.

- eCommerce framework
- Gateway framework
  - Home
  - Multimedia
- Industrial Application
  - Graphical Automation
    - SCADA
    - LabVIEW
    - Mathlab
    - MATRIXx
    - Others
  - Motor Control
    - Multi-axis motion control
    - Servo Controller
  - Display
  - Networking Solutions
    - OPC
    - EtherNET/IP
    - DeviceNET
    - ProfiBus
    - MultiBus
  - Programmable Logic Control (PLC)
- Satellite Communications framework
- Automotive
  - OSEK
- Networking
  - Managed Switch platform
  - Switch platform
  - Router platform
- Chip Manufactures
  - GWGEM generic equipment model for Semiconductor Industry
  - SECS Semiconductor Equipment communications Standards

### **Application Specific solutions**

- AI framework
- JAVA framework
  - JINI
- OSGi Service Platform
- DSP framework
- Digital Radio
- Video Capture and Playback
- Broadcast band Tuner Framework
- Printing framework
  - PDL Page Description Languages
    - Postscript
    - HPGL

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- PCP Printer control protocols
  - PJL (by HP)
  - IEEE 1284.1
  - WPS (Microsoft Windows Printing System)
- Example companies
  - Zoran (purchased OAK Technologies)

## Graphics

- Graphics Chip Set Device Drivers
  - Vector
    - UGL
  - X
  - Motif
  - OpenGL
    - Example Companies
      - Imagination Technologies
  - Bitmap
    - JPEG
    - GIF
  - GUI
    - Rendering engine
    - CGM
    - Text input and display
    - Digital Imaging
  - HTML
  - Text Input and Display (TID)
  - Font
    - UFST
  - Adobe PDF
  - Macromedia Flash
  - Video
    - MPEG-2
    - MPEG-4
    - AVI
    - MOV
    - DVD
  - CODEC
  - JAVA
    - Swing

## Operating Systems

- A simple loop
- State machine
- Scheduler
- Kernel
- Operating System, thread model

- VxWorks
- LynxOS
- VRTX
- ThreadX
- Integrity
- Nucleus
- OSE
- Symbian
- Operating System, process model
  - Embedded DOS
  - Embedded Linux
    - MontaVista
    - LinuxWorks
    - TimeSys
  - Embedded Solaris
  - Embedded BSD/OS
  - Embedded Windows
  - WIN CE .Net
  - Pocket PC
  - Palm OS
  - QNX
- Java Virtual Machine (JVM)
  - JVM
    - P Java
    - K Java
    - Enterprise Java
    - Real-Time

## **Operating System Enhancements**

- Shell
- Debug Agent
- Java Bean
- POSIX Threads Library
- Win32 library
- Alternate task scheduler
- Input/Output (I/O) library
  - Asynchronous
  - Synchronous
- Virtual memory
  - Memory Management Unit (MMU) Library
  - Cache Memory Optimization
  - Memory Protection
    - Example Companies
    - Express Logic
- Flash Memory
  - Memory management Library

- Wear leveling Library
- Interpreter
  - Basic
  - Java Byte-code
  - JIT Compiler
  - .NET
- File System
  - Hard Disk
    - DOS
    - ext2
  - Flash
  - Journaling
  - CD-ROM
- Mass Storage Interfaces
  - ATA
  - SCSI
- Messaging Service
- Secondary OS integrated with primary OS
  - Linux + RTOS
  - Windows + RTOS
- Multi-processor Designs
  - SMP
    - Example companies
      - QNX
    - Asymmetric Multiprocessing
      - Example companies
        - Express Logic
    - DSP Extensions
      - Example companies
        - Catalytic
        - Enea
        - Berkeley Design
- Translation of one operating system to another
  - VxWorks to LynxOS
  - VxWorks to Linux
  - pSOS to VxWorks
  - Windows to VxWorks
- Device Management
  - CLI
  - Web
  - Java
    - Applet
  - SNMP
  - Security
  - Graphical design interface to a host tool
  - Remote or Field software upgrade

- Resource management
- Power reduction software
  - Dynamic
  - Static
  - Example companies
    - Power Escape
- Timing
  - Periodic
  - Health Monitoring

## **Telecommunication Software**

- T1 Trunk Processing
- Device Management
  - CMIP
  - GDMO
  - Q3
  - TMN Network Management
  - TR 303
  - OSI
- WAN Network Drivers
  - SDLC
  - SNA Protocol
    - WAN-to-WAN
    - WAN-to-LAN
- ATM Drivers
  - ATM
  - HDLC
  - PPP
  - Multilink
  - X.25
  - Frame Relay
- Modem (customer premises equipment CPE)
  - ISDN
  - DSL
    - DSLAM
  - Cable
  - FAX
- SS7
- AAL2
- RTCP
- VoIP
  - MGCP
  - Megaco
  - SCTP
  - SIP
  - H.323

## STREAMS protocol

### **Wireless**

- Bluetooth Stack
- 802.11 a
- 802.11 g
- 802.11 b

### **Data Acquisition**

- By function
  - Vibration
  - Audio Frequencies
  - Radio Frequencies
  - Frequency counter
  - Pulse Counter
- By product
  - LabVIEW
  - Mathlab
  - MATRIXx
- Sensor measurement

### **Math Libraries**

- DSP Math libraries
- Floating Point libraries
- Vector Libraries
- Matrix Math Libraries
- Linear Regression Math Libraries

### **Data Communication**

- Parallel I/O
  - D/A
  - A/D
  - Printer
- Serial I/O
  - RS232 UART
  - RS422 UART
  - V.35/Bell
- Shared Memory
  - FDDI
  - Fibre (Fiber) Channel
    - 802.2 LLC FC driver for IP over FC
    - FCP Target Mode Driver
    - FCP Initiator Mode Driver
    - File Servers



- RAID solutions
- SAN
- Video Editing
- SNMP
- Protocols
  - FC-AL
  - FC-AL2
  - FC-FLA
  - FC-GS2
  - FC-PH, -2, -3
  - FC-PI,
  - FC-PLDA
  - FC-SW, -2
  - FCP
  - FC-FG
- Fibre (Fiber) Express
- Intelligent communication
  - USB protocol stack
    - On The Go
    - Host Controller
      - OHCI
      - UHCI
      - non-OHCI/UHCI
    - Class Drivers
      - Audio Devices
      - Keyboard
      - Mouse
      - Hub
      - Scanner
      - Digital camera
      - Mass Storage
  - Firewire (IEEE 1394) protocol stack
    - IDB-1394 (automotive)
  - PCMCIA protocol stack
  - IrDA protocol stack
- Misc. peer to peer communication methods
- Network Interface
  - Ethernet
    - NIC adaptor/Driver
    - MAC driver
- Network Applications
  - DHCP
  - DNS
  - FTP
  - TFTP
  - LDAP

- AppleTalk
- Proprietary
- NFS
- CIFS
- Mobile IP
- OSGi Service Platform
- PPPoE
- RIP
- SNTP
- XTP Xpress Transport Protocol
- HTTP
- Proprietary applications
  - Smart Sockets Messaging
- Bandwidth control
  - QoS
- Universal Plug-and-Play (UPnP)
- Network stack
  - TCP/IP
    - IPv4
    - IPv6
    - Virtual Routing
    - Trunking
    - OSPF
      - v1
      - v2
    - RIP
      - v1
      - v2
    - Bridging
- Network Management
  - SNMP
    - v1
    - v2
    - v2c
    - v3
    - MIB agents
  - TL1 agent
  - Multi-protocol
  - RMON / RMON2 Protocol
  - AgentX
  - Web Server
  - CLI
  - Custom
- Local Area Network (LAN)
  - IEEE 802.1 Higher layer LAN protocols
  - 801.1X port-based network access control

- IEEE 802.2 Logical link control
- IEEE 802.3 Ethernet
- IEEE 802.4 Token bus
- IEEE 802.5 Token Ring
- IEEE 802.6 metropolitan area networks
- IEEE 802.7 broadband TAG
- IEEE 802.8 fiber optic TAG
- IEEE 802.9 isochronous LAN
- IEEE 802.10 Security
- IEEE 802.11 Wireless LAN
- IEEE 802.12 demand priority
- IEEE 802.13 (not used!)
- IEEE 802.14 Cable modems
- IEEE 802.15 Wireless PAN
- IEEE 802.16 Broadband wireless access
- IEEE 802.17 Resilient packet ring
- IEEE 802.20 Mobile Broadband Wireless Access

Metropolitan Area Network (MAN)

- ATM
- FDDI
- SMDS
- Gigabit Ethernet

Wide Area Networks (WAN)

- X.25
- ATM
- Frame relay

Security

- SSL Secure Socket Layer
- BSAFE
- SSH Secure Shell
- NAT Network Address Translation
- Firewall
- RADIUS Remote Authentication
- Web Server Security
- IKE Internet Key Exchange
- IPSec Internet protocol Security
- L2TP Layer 2 Tunneling Protocol
- VPN Virtual Private Network
- Cryptography Encryption/Decryption library
  - Elliptic Curve Cryptography by Certicom
- Intrusion Detection
- Digital rights management
- Kerberos
- SSO single sign-on

Terminal Emulation

ASN.1

## **Internet Software**

- Web Server
- Web Browser
- JavaScript engine
- Java Applet
- Voice over IP (VoIP)
- CGI
- XML
- SOAP
- email
- SMTP

## **Storage**

- Database
  - ISAM
  - SQL
  - B-Tree
  - C-Tree
  - Fault Tolerant
  - Object
  - Relational
  - Flat
  - ODBC
  - JDBC
  - High Availability
  - in-memory
- RAID
- NAS
- SAN

## **Multimedia Software**

- Sound chip Device Driver
- Speech Processing Software
  - Speech Interface
    - Speech Recognition
      - Word-based
      - Phonetic-based
    - Text to Speech
- Digital Audio
- Midi
- Tone Detection
- Voice compression
- Voice decompression
- Media Oriented Systems Transport (MOST)
  - Drivers

## Host Tool

### Host-target

IDE Frameworks

Target Server

Example IDE companies

Wind River

Eclipse

API

Client/Server (Host to Target)

Monitor

Java Bean

Human Machine Interface (HMI or MMI)

Graphics User Interface (GUI)

Debugger

Single-core

Multi-core

Trace

Trigger

Watch-point

Logic Analyzer Interface

Run Control Interface

PROM interface debugger

In-Circuit Interface

Shared Memory

Example companies

EPI

McGreggor

Lauterbach

Wind River

American Arium

XJTAG

Tektronix

Compiler

Cross Compiler

C

C++

Java

Jovia

Ada 95

Ada

FORTRAN

Code Translation Software

CISC to RISC Assembly Translation

FORTRAN to C Translation

Ada to C translation

- C++ Templates
  - MFC
  - STL
- Assembler
- Simulator
- Emulator
- Makefile
- Loader
- Locator
- Archiver
- Linker
- Code Editor
- Help File Editor
- Document Tools
  - Microsoft
    - Word
    - PowerPoint
    - Publisher
  - Adobe
    - Acrobat Reader (PDF)
    - Illustrator
    - Photoshop
- HTML
- RTL
- Framemaker
- Macromedia
  - Freehand

## **Design tools**

- Software design tools
  - Specification tools
  - Requirements Management
  - Configuration Management
  - BSP development
  - Device Driver development
  - Change Management
  - Application modeling
    - Object oriented
    - State Matching Process
      - Event Scheduling
      - Real-Time Scheduling
  - Code Generation
  - Documentation
  - System architecture
  - Component
  - GUI

- Network
  - Distributed Application Management
    - Startup
    - Monitor and Control
    - Coordinated shutdown
  - Data logging
  - Database
    - Schema
    - Query
  - Test designer
    - Test case administration
    - Validation
    - Verification
  - Profiling
  - Simulation
  - Visualization
- SDL based case tool
- UML
- XT-UML
- Proprietary Case Tool Environments
  - 4GL
  - Prosys
  - Prototype with code generation
    - Virtual
    - Graphical
  - Test and Product Configuration
  - Sales Demos
  - Application-tailored Development
  - Rapid Application Development
  - Field Diagnostics
- Real-Time code design tools
  - RMA analysis and simulation
    - Example Companies
      - Tri-pacific Software
      - TimeSys
  - Benchmarking Real-Time Performance
    - Example Companies
    - Express Logics
- RT-UML
- SDL
- Proprietary Environments
  - Preemptive vs. cooperative concurrency
- Device Driver Code Design Tools
- BSP Code Design Tools
- FPGA Design and Programming tool
- Handle C Design Tool

- PLD Design and Programming Tool
- Soft Processor Design Tool
- EDA tool
  - Analog/Mixed Signal Simulation
  - Design Entry
  - Design For Test Tools
  - Design Management
  - Programmable Logic Tool Suites
  - Hardware/Software Co-Verification
    - Simulation
    - Performance Monitoring
  - IC Physical Design
  - IC Physical Verification
  - Logic Verification
  - PCB/MCM Design
  - Synthesis
  - Example Companies
    - Mentor Graphics
    - Cadence
    - Synopsis
    - CoWare

## **Virtual platform**

- Simulate Embedded System From UNIX, Linux, Windows
  - Hardware Simulation
    - Example Companies
      - Virtio
  - Source Code Simulation
  - Cycle-Accurate Simulation
    - Example Companies
      - First Silicon Solutions
      - Starcore
- Hardware Assisted Platforms
  - Example Companies
    - AXYS

## **Test**

- Automated Scripts
  - Unit Test
  - Code Coverage
  - System Test
  - Test Harness
- SNMP
- RMON
- CPU
- I/O



## Cache Analysis and Optimization

Example Companies

Lauterbach

## System-Level Design

### Industrial

Engine

Motor

Pressure

Temperature

Fluid

## Static Code Test

Schedulability Analysis

Source Code Analysis

Object Code Analysis

Test Features

Using Uninitialized Memory

Dereferencing Invalid

NULL Or Uninitialized Pointer

Dereferencing Pointer To Freed Memory

Freeing Invalid, Uninitialized Or NULL Pointer

Freeing Pointer In Middle Of Memory Block

Freeing Pointer To Already Freed Memory

Freeing A Pointer To Global, Static Or Stack Memory

Illegal Value (E.G. Dividing By Zero)

Memory Leak

Resource Leak

Resource In Illegal State

Returning Pointer to Freed or Stack Memory

## Dynamic Code Test

RTOS Task Event, Object, Timing Analysis

Profiling

Utilization and Schedulability

Rate Monotonic Analysis

Application Data and Event Analysis

Code Coverage Analysis

Memory Analysis

Source Code Execution Analysis

## Technical Support

Patch Delivery Tool for Software Updates

Remote Field Upgrade Host Support

## **Project Management**

Version Control

## ***Text Documents and Publishing***

### **Algorithms**

#### **Software**

Dictionary of Algorithms and Data Structures: <http://www.nist.gov/dads/>  
Numerical Recipes <http://www.nr.com/>

#### **Hardware**

#### **Hardware/Software**

FPGA

### **Standards**

RFC

IEEE

New Standards Seeking Approval or a Governing Body

### **Benchmarks**

Licensing Methods

Binary

Source

Open-source

GPL

Royalty

Shareware

## ***Abstract Models***

### **UML libraries**

### **SDL Libraries**

### **EDA Libraries**

### **IP libraries**

#### **Language**

Verilog

RTL

VHDL  
Handle C

## ***Miscellaneous***

**Electrical**

**Optical**

**Fluid**

**Nanotechnology**

**Biological**

**Thermal**

**Mechanical**

## **Enabling Services**

***IC Foundry***

***Design***

***Contract Assembly/Test***

***Distributor, reseller, VAR, System Integrator***

***Marketing***

***Business Development***

***Research Lab, University, Commercial Lab***

***User Group, Standards Committee, Open Source Web Site***

***Venture Funds***

***Legal / Patent / Copyright Protection of Intellectual Property***

***Media, Editors, Journalists, Events Management, Publications***

**Publishers**

Reed

Communication Systems Design

Initial draft for a comprehensive components and tools list as a standard for the embedded marketplace.

Electronic Products  
EETimes  
Electronic Design  
EE Product News  
Dr. Dobbs Journal  
Embedded Systems Programming  
Integrated System Design