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.

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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

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**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)
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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
Fujitsu Micro
SPARClite
Sun Micro
UltraSparc
SPARC Ilep
JAVA
Processor
Co-processor
MIPS32 cores
IDT
R5000
QED
RM5260
RM5230
Toshiba
LSI Logic

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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
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- 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

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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
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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
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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
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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

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- 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
- CPC1
- VXI
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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

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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 Counsels
    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
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- 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
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**Software**

**Language**

<table>
<thead>
<tr>
<th>Applicative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic</td>
</tr>
<tr>
<td>C</td>
</tr>
<tr>
<td>Pascal</td>
</tr>
<tr>
<td>Modula</td>
</tr>
<tr>
<td>FORTRAN</td>
</tr>
<tr>
<td>Ada</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Concurrent, Distributed, and Parallel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data-flow</td>
</tr>
<tr>
<td>Lisp</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDL</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Extensible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macro and Assembly</td>
</tr>
<tr>
<td>Microprogramming</td>
</tr>
<tr>
<td>Nondeterministic</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nonprocedural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prolog</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Object-Oriented</th>
</tr>
</thead>
<tbody>
<tr>
<td>C++</td>
</tr>
<tr>
<td>Java</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specialized Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forth</td>
</tr>
<tr>
<td>Postscript</td>
</tr>
<tr>
<td>Verilog</td>
</tr>
<tr>
<td>VHDL</td>
</tr>
<tr>
<td>SGML</td>
</tr>
<tr>
<td>TeX</td>
</tr>
</tbody>
</table>
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**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
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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

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- 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

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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
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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

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- 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
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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

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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
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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

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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
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**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

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**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
- McGregor
- Lauterbach
- Wind River
- American Arium
- XJTAG
- Tektronix

Compiler

Cross Compiler
- C
- C++
- Java
- Jovia
- Ada 95
- Ada

Code Translation Software
- CISC to RISC Assembly Translation
- FORTRAN to C Translation
- Ada to C translation
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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
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- 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

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- 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

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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

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**Project Management**

**Version Control**

**Text Documents and Publishing**

**Algorithms**

**Software**


**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

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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

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