

High Tech Talk

Hardware

Korenix JetBox series is a total solution of embedded computer. It is a RISC or X86 CPU based computer with versatile peripheral interfaces, communication capabilities and storage expansibilities. Ready-to-use is the key point while embedded computer hardware becomes more standardized. Built-in OS (Linux, WinCE, or Windows XP embedded), supporting services and daemons and providing application development tools for users to develop their own applications are the advantage of Korenix. All SW functions like OS, drivers, and middleware are ready in one CF card for better system integration.

CPU

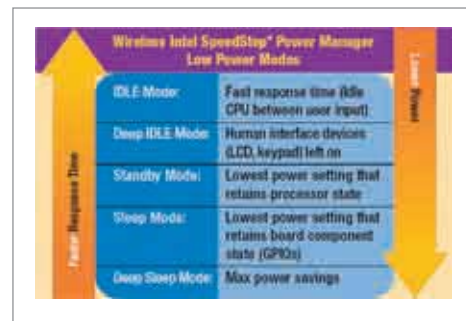
CPU is the core part of embedded computer hardware. Today's embedded applications demand a unique set of features, packaging, product life cycle and performance.

Intel Xscale PXA270

The Intel PXA270 processor is packaged specifically for the embedded market and is ideal for the low-power framework of battery-powered devices. Designed from the ground up, the Intel PXA270 processor redefines what an embedded device can do by incorporating innovative new features and enhancements from the world of the PC.

- The first Intel XScale® technology-based processor to include Intel® Wireless MMX™ technology. This enables high-performance multimedia acceleration with an industry proven instruction set.
- Intel® Quick Capture technology provides one of the industry's most flexible and powerful camera interfaces for capturing digital images and video.

- The new capabilities of Wireless Intel SpeedStep® Power Manager Technology provide a quantum leap forward in low power operation, while maintaining the highest levels of performance.



- Embedded Features: Temperature ranges are extended to -40 ~ 85°C ambient to meet the specific requirements of the embedded market and a life cycle is anticipated as 5 years.

AMD Geode LX800

The AMD Geode™ LX 800@0.9W* brings x86 power and versatility to applications for entertainment, business, education, and embedded markets. The AMD Geode LX processors' integrated and innovative architecture delivers the most performance per watt available in the industry today, and can lead to longer battery life and enable small form-factor designs.

- The most performance per watt available in the industry today
 1. Low power x86 performance
 2. 1.8W Typical (3.9W TDP) @ 500MHz
 3. GeodeLink active hardware power management
- Natively run all Windows and Linux based applications
- Full Internet browser experience on portable devices

CPU specifications

Processor	Intel Xscale PXA270 416MHz (Max to 624MHz)	AMD Geode LX 800 500Mz
L1 Cache	32K-I / 32K-D	64K-I / 64K-D
L2 Cache	128KB	SRAM 256KB
System memory	SDRAM 128MB , MAX 256MB	SDRAM 256MB , MAX 512MB
share VGA memory	Independent memory	Video UP to 256MB Max share system memory. AGP 2D/3D
COM Port	Three high-speed UARTs	RS232/422/485 x1, RS-232 x3
USB Port	USB 1.1 Host and Device Interface	4 x USB ports, USB 2.0 compliant
CF/PCMCIA	CF Card I and II / SD / MMC / PCMCIA	CF Card Type I and II / PCMCIA
Audio	Support AC97 / I2S codec	Audio AC97 Code (CS5536 Built in)
TV- Out	N/A	Support TV Encoder NTSC and PAL
GPIO	Internal GPIO controller	External IC to SMBus
Ethernet	MAC Address to Bridge	PCI to Bridge
CRT Display	Built in driver supports up to 800 x 600 x 16-bit color standard	1920x1440x32bpp at 85Hz 1600x1200x32bpp at 100Hz
LCD TFT Interface	LCD panel controller supports displays up to 800 by 600	Supports up to 24-bit TFT LCD
LVDS Interface	DSTN Passive LCD Panel	Support 1 channel 18-bit LVDS interface
JTAG	Hardware debug Interface	ATPG, Full Scan, BIST on all arrays
Watch Dog Timer	Use GPIO Reset Time controller	255 timer interval, setup by software(Super I/O controller)
OS	Linux 2.6.x Windows CE 5.0	Linux 6.5 WincE.NET/ Windows 2K/NT/XP
Ultra Low power	Low voltage 0.85V Low watt 500 mW	Low watt 0.9W / Max watt 3.9W

Expansibility: CompactFlash card (CF card)

CompactFlash® is a small, removable mass storage device. They provide complete PCMCIA-ATA functionality and compatibility. Flash memory devices are non-volatile and solid state, and thus are more robust than disk drives, and consume around 5% of the power required by small disk drives, and yet still have good transfer speeds (up to 40 MB/s write and 40 MB/s read for the SanDisk Extreme IV). CF cards with flash memory are able to cope with extremely rapid changes in temperature. Industrial versions of flash memory cards can operate at a range of -45 to 85°C. Flash based SSDs (Solid State Disk) have several unique advantages:

- Faster startup
- Faster read time

- Low read and write latency (seek) time
- Faster boot and application launch time
- Lower power consumption and heat production
- No noise
- Better mechanical reliability
- Lower but improving read-write lifetime
- Security
- Deterministic performance
- Lower weight and (depending upon type) size

There are two main subdivisions of CF cards, Type I and the thicker Type II (CF2) cards. The CF Type II slot is used by Microdrives and some other devices. There are four main speeds of cards including the original CF, CF High Speed (using CF+/CF2.0, 16Mbyte/s data-transfer), a faster CF 3.0 standard (max. 66 Mbyte/s) and a yet faster CF 4.0 standard (max. 133MB/s) that is being adopted as of 2007.

Technical details

Card	Varieties	Max. storage capacity, MB	Theoretical max. capacity	Data read speed, MB/s	Data write speed, MB/s	Low-level access	Operating voltage, V	Controller chip	# of pins
Compact Flash	I	8000	137 GB	40	40	NOR	3.3 and 5	Yes	50
	II	12000	137 GB	40	40				

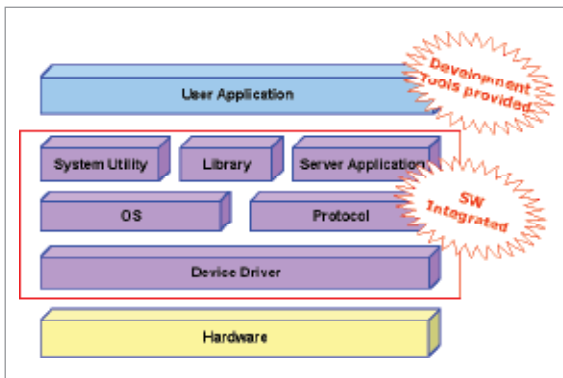
Watchdog timer

The most common use of watchdog timers is in embedded systems, where this specialized timer is often a built-in unit of a microcontroller. A watchdog timer is a computer hardware timing device that triggers a system reset if the main program, due to some faults condition, such as a hang, neglects to regularly service. The intention is to bring the system back from the hung state into normal operation. And it is useful function in industrial applications to keep the system stable and recover from fault condition soon.

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Software

Following chart is a rough software structure of embedded computer. Since embedded computer peripheral are various, providing device drivers becomes an essential requirement of SW. Besides, in a network environment today, communication capability becomes more and more important. Protocol and server application ready is useful for connection, communication or data transmission. Moreover, to meet the specific tasks in different industries, industrial users may develop their own applications so providing a friendly development environment in PC will be a benefit for industrial users to save time and money. To summarize, ready-to-use will be the key point for today's embedded computer.



Protocol

In computing, a protocol is a convention or standard that controls or enables the connection, communication, and data transfer between two computing endpoints.

Generally, most protocols, especially in the context of communications or networking, are layered together into protocol stacks where the various tasks listed above are divided among different protocols in the stack. Whereas the protocol stack denotes a specific combination of protocols that work together, the Reference Model is a software architecture that lists

each layer and the services each should offer. The classic seven-layer reference model is the OSI model (Open System Interconnection model), which is used for conceptualizing protocol stacks and peer entities. The widespread use and expansion of communications protocols is both a prerequisite to the Internet, and a major contributor to its power and success. The pair of Internet Protocol (or IP) and Transmission Control Protocol (or TCP) are the most important of these, and the term TCP/IP refers to a collection (or protocol suite) of its most used protocols.

Description of OSI layers

	Data unit	#	Layer	Function
Host layers	Data	7	Application	Network process to application
		6	Presentation	Data representation and encryption
		5	Session	Interhost communication
		4	Transport	End-to-end connections and reliability
Media layers	Packets	3	Network	Path determination and logical addressing (IP)
	Frames	2	Data link	Physical addressing (MAC & LLC)
	Bits	1	Physical	Media, signal and binary transmission

Layer 1 protocols (Physical layer)

- RS-232, a serial line interface
- ...etc

Layer 2 protocols (Data link layer)

- ARP Address Resolution Protocol
- PPP Point-to-Point Protocol
- ...etc

Layer 3 protocols (Network layer)

- ARP Address Resolution Protocol
- ICMP Internet Control Message Protocol
- IGMP Internet Group Management Protocol
- IPv4 Internet Protocol version 4
- ...etc

Layer 4 protocols (Transport layer)

- TCP Transmission Control Protocol
- UDP User Datagram Protocol
- ...etc

Layer 5 protocols (Session layer)

- NFS Network File System
- ...etc

Layer 7 protocols (Application layer)

- DHCP Dynamic Host Configuration Protocol
- FTP File Transfer Protocol
- HTTP HyperText Transfer Protocol
- NTP Network Time Protocol
- SSH Secure SHell
- SMTP Simple Mail Transfer Protocol
- SNMP Simple Network Management Protocol
- SOAP Simple Object Access Protocol
- Telnet, a remote terminal access protocol
- ...etc

System Utility (Shell)

In computing, a shell is a piece of software that provides an interface for users (command line interpreter). Typically, the term refers to an operating system shell which provides access to the services of a kernel. Operating system shells generally fall into one of two categories: command line and graphical. Command line shells provide a command line interface (CLI) to the operating system, while graphical shells provide a graphical user interface (GUI).

Linux

- **Bash:** the shell, or command language interpreter on most Linux systems.
- **BusyBox:** The Swiss Army Knife of Embedded Linux. It is designed to be a small executable for use with Linux, which makes it ideal for special purpose Linux distributions and embedded devices.
- **TinyLogin:** A suite of tiny UNIX utilities handles logging into, being authenticated by, changing one's password for, and otherwise maintaining users and groups on an embedded system. It also provides shadow password support to enhance system security.

WinCE

- **Windows command shell**
- **Web-based administration manager**

Server application

In information technology, a server is a computer system that provides services to other computing systems—called clients—over a computer network.

Server applications are tailored to the tasks performed by servers. Most server applications run unobtrusively within the server and interact only with client computers on the network to which the server is attached. Applications of this kind are called daemons in UNIX terminology, and services in Windows terminology.

Linux (daemon)

- **sshd (secure shell server)**

Secure Shell or SSH is a set of standards and an associated network protocol that allows establishing a secure channel between a local and a remote computer. An ssh program commonly appears for use on Unix-like systems for client connections as well as a daemon such as sshd for accepting remote connections.

- **Apache**

The Apache HTTP Server is a web server for Unix-like systems, Microsoft Windows, Novell NetWare and other operating systems.

- **MySQL**

MySQL is a multithreaded, multi-user, SQL Database Management System (DBMS).

It is popular for web applications and acts as the database component of the LAMP platforms (Linux operation system, Apache server, MySQL database, PHP programming language)

- **OpenVPN**

OpenVPN is a virtual private network (VPN) package for creating point-to-point encrypted tunnels between host computers.



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■ snmpd (simple network management protocol agent daemon)

SNMP is used by network management systems to monitor network-attached devices for conditions that warrant administrative attention. It consists of a set of standards for network management, including an Application Layer protocol, a database schema, and a set of data objects. An agent is a network-management software module that resides in a managed device. An agent has local knowledge of management information and translates that information into a form compatible with SNMP. The SNMP framework consists of master agents, subagents and management stations. A master agent is a piece of software running on an SNMP-capable network component, for example a router that responds to SNMP requests from the management station. A master agent relies on subagents to provide information about the management of specific functionality.

WinCE (service)

■ IIS (Microsoft Internet Information Services)

Microsoft Internet Information Services is a set of Internet based services for servers using Microsoft Windows. The servers currently include FTP, SMTP (simple mail transfer protocol), NNTP (network news transfer protocol) and HTTP/HTTPS.

Basic common features:

1. HTTP: responds to HTTP requests.
2. Logging

In practice many Web servers implement the following features too:

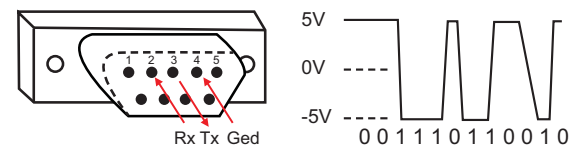
1. Authentication, optional authorization request (request of user name and password) before allowing access to some or all kind of resources.
2. Handling of not only static content (file content recorded in server's filesystem(s)) but of dynamic content too by supporting one or more related interfaces (SSI, CGI, SCGI, FastCGI, PHP, ASP, ASP.NET, Server API such as NSAPI, ISAPI, etc.).
3. HTTPS support (by SSL or TLS) in order to allow secure (encrypted) connections to the server on the standard port 443 instead of usual port 80.
- 4....etc.

Modbus

Modbus is an open serial communications protocol based on master/slave architecture and used to connect a supervisory computer with a remote terminal unit (RTU) in supervisory control and data acquisition (SCADA) system. Versions of the Modbus protocol exist for serial port and Ethernet.

- Modbus RTU is a compact, binary representation of the data. RTU format follows the commands/data with a cyclic redundancy check (CRC) checksum.
- Modbus ASCII is human readable and more verbose. ASCII format uses a longitudinal redundancy check checksum.
- Modbus TCP is very similar to Modbus RTU, and could be defined as Modbus RTU inside a TCP/IP connection, with 6 byte header to allow routing.

Modbus is transmitted over serial lines between devices. The simplest setup would be a single serial cable connecting the serial ports on two devices, a Master and a Slave.



The data is sent as series of ones and zeroes called bits. Each bit is sent as a voltage. Zeroes are sent as positive voltages and ones as negative. The bits are sent very quickly. A typical transmission speed is 9600 baud (bits per second).

Each device intended to communicate using Modbus is given a unique address and Modbus is restricted to addressing 254 devices on one data link.

Besides, Modbus was designed in the late 1970's to communicate to programmable logic controllers. The number of data types are limited to those understood by PLCs at the time. Large binary objects are not supported. No standard way exists for a node to find the description of a data object.