expresslogic
Making things better at work, at home, at play
Express Logic, Inc., is a San Diego, CA based developer of real-time operating systems (RTOS) and related products for embedded applications. Founded in 1996, Express Logic recently celebrated its 12th year in business.

Express Logic was founded by William E. (Bill) Lamie and David L. Lamie. Self-funded and privately operated for all 12 years since its inception, Express Logic has achieved continuous profitability and an average of 30% annual growth.

Express Logic’s products include the popular ThreadX® real-time operating system (RTOS), NetX™ TCP/IP stack, FileX® embedded file system, USBX™ host/device USB stack, PEGX™ an embedded GUI development kit, BenchX® Eclipse-based IDE, and TraceX® graphical real-time event trace utility.

Developer Surveys

What RTOS are you likely to use (for ARM, MIPS, or Coldfire)?

Top 5 In Market Demand

Each year, TechInsights, Inc., conducts a survey of embedded developers drawn from attendees of the Embedded Systems Conferences, readers of EETimes and Embedded System Design magazines, and visitors to www.embedded.com. Developers are asked a series of questions, including, “What RTOS are you currently using?” As shown in the results for 2006, Express Logic’s ThreadX RTOS ranks in the Top 5 among all RTOSes being used for ARM®, MIPS® or ColdFire® processor architectures.

Fast Time to Market

Another survey, conducted by Embedded Market Forecasters in 2006, and repeated in 2008, shows that developers who used ThreadX reported that they completed their development projects on-time or ahead of schedule more often than those using other RTOSes – including Linux – over 70% of the time! Use ThreadX and get YOUR next product to market faster.
Who is using our Products?

Markets Served

- Consumer Devices. With over 600 million consumer devices powered by Express Logic’s ThreadX RTOS, NetX TCP/IP networking stack, and FileX file system, Express Logic outpaces all other suppliers to consumer device development.

- Medical Devices. From hand-held diagnostic equipment to respirators and ventilators, Express Logic products meet the needs of medical device manufacturers, and the requirements of FDA certification.

- Networking. From wireless, hand-held devices to cell phones, to DSL routers, Express Logic’s products are ideal for high-performance data networking applications.

- System-On-Chip (SoC) manufacturers increasingly turn to Express Logic’s ThreadX for its small, fast and royalty-free benefits. Express Logic enables SoC development with the fastest time-to-market and lowest possible cost.

- Industrial Automation/Automotive. Express Logic delivers cost-effective solutions for industrial automation and automotive applications.

- Aerospace/Defense. Developers employ Express Logic’s products because of their small memory footprint, ease of use, and ease of certification for demanding FAA applications.

Rep resentative ThreadX Deployments

<table>
<thead>
<tr>
<th>Product Category</th>
<th>ThreadX Deployments</th>
<th>Representative Customers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wireless Networking</td>
<td>300,000,000</td>
<td>Broadcom, Intel, Marvell</td>
</tr>
<tr>
<td>Ink-Jet Printers</td>
<td>225,000,000</td>
<td>HP, Sharp</td>
</tr>
<tr>
<td>Baseboard Management Controllers</td>
<td>30,000,000</td>
<td>Intel, QLogic</td>
</tr>
<tr>
<td>Cell Phones</td>
<td>20,000,000</td>
<td>Samsung, Infineon, Datang</td>
</tr>
<tr>
<td>Digital TV</td>
<td>15,000,000</td>
<td>Sony, Pioneer, Zoran</td>
</tr>
<tr>
<td>Digital Cameras</td>
<td>15,000,000</td>
<td>HP, Pentax, Zoran</td>
</tr>
<tr>
<td>DVD Recorders/Players</td>
<td>6,500,000</td>
<td>Toshiba, Sharp, Zoran</td>
</tr>
<tr>
<td>Storage Devices</td>
<td>3,000,000</td>
<td>ST, Quantum</td>
</tr>
<tr>
<td>DSL/Cable Modems</td>
<td>3,000,000</td>
<td>Conklin</td>
</tr>
<tr>
<td>Medical Devices</td>
<td>1,000,000</td>
<td>Welch-Allyn</td>
</tr>
<tr>
<td>Digital Radio</td>
<td>750,000</td>
<td>iBiquity</td>
</tr>
<tr>
<td>Space Probes</td>
<td>2</td>
<td>NASA</td>
</tr>
</tbody>
</table>

This chart shows an approximate breakdown of more than 600 million devices into product categories such as wireless devices (bluetooth, baseband radio, WiFi), Printers, Cameras, Digital TV, and the like. You can see the types of products most widely developed using ThreadX, and some representative customers who make those products.

Partners

Express Logic is extremely proud to have many industry leading partners who provide technologies that complement our own products. From development tools, to communications middleware, to microprocessors, and more, Express Logic’s partners form an ecosystem that enables developers to choose ThreadX-compatible, integrated, and supported products to complete their needs.

Business Model

Express Logic’s business model is based on a royalty-free approach. We do not charge per-unit fees for deployed units. Instead, we charge for licenses that authorize the use of ThreadX in the development and production of individual, or a family of products. In all cases, full ThreadX source code is provided, and direct telephone, e-mail, and in-person support is available for an annual fee.

Hewlett Packard has licensed the use of ThreadX for all Inkjet and all-in-one devices.

Zoran uses ThreadX in its SoCs for digital cameras, and other consumer electronic devices.

ThreadX is widely used in networking controlling Bluetooth and Baseband Radios in cell phones.

Welch Allyn uses ThreadX in a wide range of its medical equipment, including defibrillators, blood analyzers, and monitors.

Pulmonetic Systems uses ThreadX in ventilators that keep paralyzed patients supplied with life-critical oxygen.

ThreadX is used in the automotive industry in a number of applications, including test equipment and digital radios.

In November, 2006, the Mars Reconnaissance Orbiter (MRO) entered an orbit around Mars and began taking spectacular high-resolution images of the Red Planet.
ThreadX is a real-time operating system (RTOS) designed for embedded, real-time applications running on microcontrollers, microprocessors, or DSPs. ThreadX’s advanced technology is optimized to make it small in size, fast in performance, and easy to use. ThreadX is royalty-free, making it especially attractive for high-volume, cost-sensitive products.

ThreadX Delivers Key Benefits to Developers
ThreadX delivers fast time to market, in a small-size, high-performance, low-cost product with broad tools and processor support. These benefits make ThreadX unmatched in value for embedded device development.

Fast Time To Market
ThreadX is easy to install, learn, use, debug, verify, certify and maintain, for multiple reasons:

1. Source Code Availability
   - Full source code for entire RTOS: Including kernel
   - Written in C: Only processor-specific code is written in assembly language
   - Well documented and commented: User guides, training, fully supported by Express Logic engineers
   - Affordably priced: No extra charge for source code

2. Easy-to-use API speeds ThreadX programming
   With about 80 easy to read and easy to understand API service calls, ThreadX is unlike otherRTOSes with “alphabet soup” names. In addition, ThreadX is provided with excellent documentation, training, and full source code. Here is an example of an application’s use of the simple ThreadX API:

   /* Get a semaphore with suspension */
   status = tx_semaphore_get(&semaphore_0, TX_WAIT_FOREVER);

   /* Check status */
   if (status != TX_SUCCESS)
       break;

   /* Sleep for 2 ticks to hold the semaphore */
   tx_thread_sleep(2);

   /* Release the semaphore */
   status = tx_semaphore_put(&semaphore_0);

   /* Check status */
   if (status != TX_SUCCESS)
       break;

3. Quickly Migrate Legacy Code
   - API “personality layers” for industry standard APIs make porting existing applications to ThreadX fast and easy - POSIX, uTRON, OSEK

4. Unmatched, Broad Tools Integration
   Developers have a wide choice of development tools that work with ThreadX
   - BenchX®: Express Logic’s new Eclipse-based BenchX IDE is designed for embedded development, and includes GNU compilers and a Debug Probe for target connection, as well as a software platform simulator. BenchX supports development based on a variety of 32-bit processor architectures.
   - TraceX®: Express Logic’s TraceX is a graphical real-time event analysis tool that helps developers understand the behavior of their systems.
   - All (except GNU) are commercially available with full support from leading tools companies like Wind River, ARM, Freescale, IAR, Green Hills, Renesas, Analog Devices, and MIPS
   - All are fully integrated and supported: Many offer kernel-aware ThreadX integration and run-mode target agent support.

Small Size
ThreadX is small in size, so it can fit even the most demanding memory size constraints imaginable. Only what is used by the application is linked into the final image. This is accomplished automatically by the linker; compilation configuration is not required.

<table>
<thead>
<tr>
<th>ThreadX Services</th>
<th>Typical Size in Bytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core Services (required)</td>
<td>2,000</td>
</tr>
<tr>
<td>Queue Services</td>
<td>900</td>
</tr>
<tr>
<td>Event Flag Services</td>
<td>900</td>
</tr>
<tr>
<td>Semaphore Services</td>
<td>450</td>
</tr>
<tr>
<td>Mutex Services</td>
<td>1,200</td>
</tr>
<tr>
<td>Block Memory Services</td>
<td>550</td>
</tr>
<tr>
<td>Byte Memory Services</td>
<td>900</td>
</tr>
</tbody>
</table>

Low Cost
ThreadX is licensed royalty-free, for the lowest possible manufacturing cost. That means that there are no per-unit royalties for deployed copies of the RTOS in manufactured products, no matter how many are produced.

ThreadX is Field Proven, lowering support costs. Proven reliability in over 600 million deployments dramatically lowers support costs.
High Performance

ThreadX delivers the highest performance found in commercial real-time operating systems, generally 30% - 50% faster than other RTOSes.

- **Fast Boot.** ThreadX boots in less than 120 cycles
- **Removal of basic error checking.** Basic ThreadX error checking can be bypassed at a compile-time, increasing performance by 20%
- **Picokernel™ Design,** with services not layered on each other, delivering faster context switching
- **Optimized Interrupt Processing.** Only scratch registers are saved/restored upon ISR entry/exit, unless preemption will take place. Interrupts taken during Idle Thread operation are further optimized to skip all save/restore.

- **Fast Interrupt Response Time.**
- **Fast Context Switching.**
- **Low RTOS Service Overhead.**

### Advanced Technology

ThreadX provides thread-management services with advanced technology for low overhead and ease of use.

- **Complete Multitasking Facilities**
  - Threads, Application Timers, Message Queues, Counting Semaphores, Mutexes, Event Flags, Block and Byte Memory Pools
- **Priority-based preemptive scheduling**
- **Preemption-threshold™** - Unique to ThreadX, helps reduce context switches
- **Determinism**
- **Event Trace** - Capture last “n” system/application events
- **Event Chaining™** - Register an application-specific “notify” callback function for each ThreadX communication or synchronization object
- **Run-Time Performance Metrics**
  - Number of thread resumptions
  - Number of thread suspensions
  - Number of solicited thread preemptions
  - Number of asynchronous thread interrupt preemptions
  - Number of thread priority inversions
  - Number of thread relinquishes
  - And more ....

- **New Debugger Thread** - Able to display information through a serial port.
- **Separate interrupt stack**
- **Run-time Stack Analysis**
- **Optimized Timer Interrupt Processing**
- **Priority Flexibility** - Up to 1024 priority levels

### Summary

In summary, ThreadX offers the best combination of low cost, high performance and ease of use, to help you get your product to market sooner, at a lower cost, and with less risk. ThreadX does this because it’s:

- **Advanced Technology** - This means your product will perform better.
- **Royalty Free** - This means lower production cost.
- **Easy To Use** - This means faster time-to-market and lower development cost.
- **Delivered With Full Source Code** - This means complete understanding and ability to customize.
- **Fast** - This means better real-time performance from a less expensive processor.
- **Small** - This means lower memory cost and smaller physical size.
- **Supported By The Best Tools In The Industry** - This means faster time to market and greater flexibility in your choice of development tools.
NetX

NetX is Express Logic’s high-performance, dual-stack IPv4/IPv6 implementation of TCP/IP protocol standards. NetX has a unique Piconet™ architecture and a zero-copy API, making it a perfect fit for today’s deeply embedded applications.

Small Footprint - NetX is implemented as a C library. Only the features used by the application are brought into the final image. The minimal footprint of NetX is as small as 10KB on RISC processors.

Piconet™ Architecture - Many TCP/IP implementations have a considerable number of function calls sprinkled throughout the packet processing path. The elimination of layered function calls and loosely coupled protocol components is what we call a piconet architecture.

Fast Response - With its non-layering Piconet™ architecture and zero-copy API, NetX’s packet processing speed is second to none.

Easy To Use - The NetX API is both intuitive and highly functional. In addition, component names are made of real words and not the “alphabet soup” names that are common to other TCP/IP products. Building a NetX application is easy. Simply include the nx_api.h file in the application software and link the application objects with the NetX library. The resulting image is ready for execution – it’s that simple!

Zero-Copy API - NetX provides zero-copy TCP/IP communication to eliminate processor cycles consumed by moving data to and from user buffers.

NetX Protocol Components - NetX provides a complete set of protocol components that comprise the TCP/IP standard, including the following:

- Flexible Packet Management
- Transmission Control Protocol (TCP)
- Internet Protocol (IP)
- User Datagram Protocol (UDP)
- Address Resolution Protocol (ARP)
- Reverse Address Resolution Protocol (RARP)
- Internet Control Message Protocol (ICMP)
- Internet Group Management Protocol (IGMP)

Flexible Packet Pool Management - The application may create any number of packet pools in any number of memory areas. These zero-copy packets can be linked with packets from the same pool or even a different pool to accommodate larger payloads.

UDP Fast Path™ Technology - Basic UDP packets pass through NetX without any copying and without any system context switches. Many commercial network stacks process all packets received within a system thread thereby adding a context switch.

NetX Applications

- Dynamic Host Configuration Protocol (DHCP)
- Point-To-Point Protocol (PPP)
- Domain Name Server (DNS)
- File Transfer Protocol (FTP)
- Trivial File Transfer Protocol (TFTP)
- Terminal Emulation (Telnet)
- BSD Sockets Interface Layer
- Hypertext transfer Protocol Server (HTTP)
- Simple Network Management Protocol (SNMP)
- Simple Mail Transport Protocol (SMTP)
- Post Office Protocol-3 (POP3)
- Simple Network Transport Protocol (SNTP)
- AutoIP
- Network Address Translation (NAT)

Here’s what Sony engineers have said about NetX:

“On this single SPE, we operated the protocol stack NetX, developed for embedded applications, and the microkernel ThreadX required for its operation. Both were manufactured by Express Logic.

As a result, we achieved a TCP performance of 8.5 Gbps for 3-KB packet sizes using a single SPE operating at 3.2 GHz.

This result indicates a competitive network protocol processing performance, considering that we employed a processor designed for a variety of computational applications rather than a dedicated network processor, and demonstrates the potential of the application of SPEs in this field.”


**FileX**

FileX is Express Logic’s high-performance FAT-compatible file system. It is fully integrated with ThreadX and is available for all supported processors. Like ThreadX, FileX is designed to have a small footprint and high-performance, making it ideal for today’s deeply embedded applications.

**Small Footprint** - FileX is implemented as a C library. Only the features used by the application are brought into the final image. The minimal footprint of FileX is as small as 6KB on CISC processors.

**Fast Response** - FileX has minimal function call layering, an internal logical sector cache, contiguous cluster allocation, and consecutive cluster reading and writing. All of these attributes make FileX extremely fast!

**Easy To Use** - FileX is very easy to use. The FileX API is both intuitive and highly functional. In addition, the service names are made of real words and not the “alphabet soup” names that are common to other file system products. Building a FileX application is also easy. Simply include the fx_api.h file in the application software and link the application objects with the FileX library.

**Easy to Integrate** - FileX is easily integrated with virtually any FLASH or physical media device

**No Mysteries** - FileX is delivered with complete C source code so you can see exactly how it operates. If you are used to in-house file systems or had bad experiences with “black box” commercial products, this should be most comforting.

FileX supports an unlimited number of media devices at the same time, including RAM disks, FLASH managers, and actual physical devices. It also supports 12-, 16-, and 32-bit File Allocation Table (FAT) formats, contiguous file allocation, and it is highly optimized for both size and performance. Designed to meet the growing need for FLASH devices, FileX uses the same design and coding methods as ThreadX. Like all Express Logic products, FileX is distributed with full ANSI C source code, and it has no run-time royalties.

**Advanced Features**

FileX provides many advanced features for embedded file applications, including the following:

- 12-, 16-, and 32-bit FAT support
- Long filename support
- Internal FAT entry cache
- Contiguous file allocation
- Consecutive sector and cluster read/write
- Internal logical sector cache

**Product Highlights**

- No royalties
- Complete ANSI C source code
- Real-time performance
- Responsive technical support
- Unlimited FileX objects (media, directories, and files)
- Dynamic FileX object creation/deletion
- Flexible memory usage
- Size scales automatically
- Small footprint (as low as 6 KBytes) instruction area size: 6-30K
- Complete integration with ThreadX
- Endian neutral
- Easy-to-implement FileX I/O drivers
- RAM disk demonstration runs out-of-the-box
- Media format capability
- Error detection and recovery
- Fault tolerant options
- Built-in performance statistics
USBX

USBX is Express Logic’s high-performance embedded USB host and device stack. It is fully integrated with ThreadX and is available for all ThreadX supported processors. Like ThreadX, USBX is designed to have a small footprint and high-performance, making it ideal for today’s deeply embedded applications that interface with USB devices or are connected with a Windows/Apple/Linux desktop over USB.

**Highlights**
- Complete ThreadX processor support
- No royalties
- Complete ANSI C source code
- Real-time performance
- Responsive technical support
- Multiple host controller support
- Multiple class support
- Multiple class instances
- Integration of classes with NetX and FileX
- Support for USB devices with multiple configuration
- Support for USB composite devices
- Support for cascading hubs
- Support for USB power management

**Small Footprint** - USBX is implemented as a C library. Only the features used by the application are brought into the final image. The minimal footprint of USBX is under 10KB.

**Easy To Use** - USBX is very easy to use. The USB API is both intuitive and highly functional. In addition, the service names are made of real words and not the “alphabet soup” names that are common to other USB products. Building a USBX application is also easy. Simply include the ux_api.h fill in the application software and link the application objects with the USBX library.

**Powerful Services of USBX**

**Multiple Host Controller Support**

USBX can support multiple USB host controllers running concurrently. This feature allows USBX to support the USB 2.0 standard using the backward compatibility scheme associated with most USB 2.0 host controllers on the market today.

**USB Software Scheduler**

USBX contains a USB software scheduler necessary to support USB controllers that do not have hardware list processing. The USBX software scheduler will organize USB transfers with the correct frequency of service and priority, and instruct the USB controller to execute each transfer.

**Complete USB Device Framework Support**

USBX can support the most demanding USB devices, with multiple configurations, multiple interfaces, and multiple alternate settings.

**Major Features**
- Host/Device/Combined Operation
- USB low speed, full speed and high speed are supported
- Supports all embedded CPUs
- Supports many USB host/device controllers in discrete or IP form integrated with a SOC including Synopsis, Philips, Atmel, Renesas SH-2A, Microchip PIC32 and NEC
- Supports many standard USB class drivers including Mass Storage, Printer, HID, Audio, Hub, RNDIS, CDC, Pima 15740 and Pictbridge
- Integrated with Express Logic components (FileX and NetX)

USBX supports the two existing USB specifications: 1.1 and 2.0. It is designed to be scalable and will accommodate simple USB topologies with only one connected device as well as complex topologies with multiple devices and cascading hubs. USBX supports all the data transfer types of the USB protocols: control, bulk, interrupt, and isochronous. USBX supports both the host side and the device side. Each side is comprised of three layers:
- Controller layer
- Stack layer
- Class layer

**USBX Host mode** - USBX in host mode is used when the application requires communication with USB devices such as a USB keyboard, a USB printer or USB Flash disk.

**USBX Device mode** - USBX in device mode is used when the application requires communication with a Windows/Apple/Linux desktop. In this case the embedded device is considered to be a USB device or slave.
The PEGX™ (Portable Embedded GUI for ThreadX) family of GUI development tools are professional quality graphical user interface packages created to meet the needs of embedded systems developers. PEGX products are small, fast, and can be used with any hardware configuration capable of supporting graphical output. PEGX also delivers exceptional visual appeal and an intuitive and powerful API for application-level user interface development. PEGX software accelerates GUI design for embedded devices by allowing developers to create prototypes on a Windows or Linux-based PC.

**PEGX Interface** - PEG's default appearance is almost identical to Windows. This makes it easy for Windows programmers to get up and running. The diagram shows some example windows, dialogs, and graphic displays created by PEGX.

**PEGX Licensing** - PEGX is licensed on a per-developed-product basis, eliminating royalty fees. PEGX is delivered with full source code, many example application programs, a complete set of supporting utility programs, hardware interface objects for several common video configurations and input devices, and very thorough documentation to simplify the integration process.

**PEGX Features**
- Completely customizable
- Multi-lingual support
- High color depth support
- Libraries delivered with full source code
- Small footprint
- Fast execution speed
- Designed for cross platform application development
- Touchscreen support

**PEGX Benefits**
- Reduce development time and costs
- Rapid user interface development
- Resolve product usability issues before committing to a physical design
- Standardize on graphics software solutions across products
- Differentiate your product with a sophisticated user experience

**PEGX Tools**
- **PEGX™** - high performance, small footprint GUI tool for monochrome to full color LCDs up to 24 bits per pixel (bpp). PEGX includes PEG WindowBuilder™, has full windowing capability, overlapping windows, simple anti-alias line and font drawing, and full set of widgets/controls.
- **PEGX Pro™** - for today’s most sophisticated graphics and high-resolution displays. PEGX Pro is designed for applications needing multiple graphic layers, screen transitions, gradient filled buttons, per pixel alpha blending, BiDi and RichTextBox, and a full set of widgets/controls. Includes PEG WindowBuilder™, and supports 16 bpp to 32 bpp color depths.
- **C/PEGX™** - extremely efficient; designed for small displays, limited memory requirements & lower color depths. Includes C/PEG WindowBuilder, FontCapture and ImageConvert utilities. This visual development environment allows for rapid prototyping of embedded interfaces, validating the design concepts and usability for key stakeholders.
- **PEG WindowBuilder™** - a complete visual layout and design tool to enable GUI design work to take place in parallel to the embedded hardware/software development. In addition — and unlike other graphic design tools — WindowBuilder automatically generates C++ or C source code that is ready to be compiled and linked into the application, further accelerating the deployment of the final product. FontCapture and ImageConvert are now built into the new PEG WindowBuilder for PEGX and PEGX Pro. Custom user-supplied control types, graphics and fonts can easily be incorporated.
BenchX

Express Logic’s BenchX™ Integrated Development Environment (IDE) is a full–featured, Eclipse-based development tools solution for embedded systems. The Eclipse community’s efforts have ushered in a new generation of IDEs and tools that can be adapted for use with embedded systems. Express Logic’s BenchX, its own new Eclipse-based IDE, is tailored for embedded development, and supports multiple 32-bit processor architectures. Best of all, BenchX is very affordable, and requires no license keys.

- Eclipse-based IDE for Embedded Development
- GNU C/C++ Compilers and Libraries
- GDB Debugger With Graphical Interface
- Project Builder, Editor, Browser, Simulator
- Hardware Debug Probe
- New Project Wizard
- No License Keys

BenchX Components

BenchX consists of the following components, all fully integrated and ready to use in a unified IDE:

Compiler/Library – BenchX is pre-configured with the GNU GCC compiler and GDB debugger. These compilation and debugging tools are launched when projects are built or re-built.

Debugger
BenchX is configured to use the GDB debugger engine, behind a graphical user interface that is a modified version of the CDT GUI. The user interface has been enhanced to support embedded development in general, and RTOS kernel awareness has been added for ThreadX. BenchX may be used with or without ThreadX, or even with no RTOS at all. There is no dependence on ThreadX, but ThreadX users will enjoy kernel awareness of all ThreadX objects in a debugger window.

Instruction Set Simulator – Executable images can run on target hardware, using the debug probe, or they can be simulated on the PC through the BenchX simulator. The Simulator runs executables built for a particular target, without having to re-build for the PC.

Builder – The BenchX Project Builder enables compiling and linking of applications with or without hands-on construction of a makefile. The builder provides a “one-click” build capability, with options for custom procedures and compiler/linker options.

New Project Wizard The BenchX New Project Wizard eases the common task of creating a new development project. The wizard provides default settings that satisfy most needs, but also enables custom options for greater developer control. The wizard is intuitive and easy to follow.

Editor – The BenchX Editor is used to construct source code, and is language sensitive for ease in formatting C or C++ instructions. The editor also provides syntax highlighting, bracket matching, formatting, and content assist. The BenchX Editor can launch Microsoft Word, or Wordpad, based on the extension of the file being opened.

Browser – The BenchX Browser is a convenient feature that assists the developer in visualizing and navigating a project’s class hierarchy by presenting it in a purely logical layout (as opposed to a file-system layout). Classes can typically be filtered and sorted by project, namespace, base class, etc. The C/C++ Browser perspective is available for both C and C++ projects.

Licensing

BenchX is licensed in executable form, for use on an individual PC, or throughout an enterprise. There are no license keys required, simply load and install BenchX and begin to use it. License-key-free operation makes BenchX unique in the world of commercial development tools, and the easiest IDE to use.

Supported Architectures

BenchX supports development targeted for 32-bit architectures. Please contact Express Logic for current availability of support for specific processors and development boards.
TraceX is Express Logic’s host-based analysis tool that provides developers with a graphical view of real-time system events and enables them to visualize and better understand the behavior of their real-time systems.

Trace Data Collected By ThreadX® RTOS

TraceX is designed to work with Express Logic’s ThreadX RTOS, which constructs a database of system and application “events” on the target system during run-time. These events include:

- Thread context switches
- Preemptions
- Suspensions
- Terminations
- System interrupts
- Application-specific events
- All ThreadX API calls

Events are logged under program control, with time-stamping and active thread identification so they can be displayed later in the proper time sequence, and associated with the appropriate thread. Event logging may be stopped and restarted by the application program dynamically, for example, when an area of interest is encountered.

Target-Resident Buffer Holds Event Log Information

Trace information is stored in a circular buffer on the target system, with the buffer location and size determined by the application at run-time. The trace information may be uploaded to the host for analysis at any time – either post mortem or upon a breakpoint.

Sequential Mode

TraceX can operate in Sequential Mode or Time Mode. In Sequential Mode, all events are displayed back-to-back, regardless of the time between them. This enables developers to see all system events, in correct sequence, compressing time into the smallest possible area.

Time Mode

In Time Mode, events are separated along the horizontal axis, according to their real-time occurrence. A time scale appears at the top to indicate the number of clock ticks between events, and the clock tick duration of each thread’s run-time.

TraceX is Like a Software Logic Analyzer

Once the event log has been uploaded from target memory to the host, TraceX displays the events graphically on a horizontal axis representing time, with the various application threads and system routines to which the events are related listed along the vertical axis. TraceX creates a “software logic analyzer” on the host, making system events plainly visible. Events are represented by color coded icons, located at the point of occurrence along the horizontal timeline, to the right of the relevant thread or system routine. When an event icon is selected, the corresponding information for that event is displayed. This provides quick, single-click access to the most immediate information about the event and its immediately surrounding events. TraceX provides a “Summary” display that shows all system events on a single horizontal line to simplify analysis of systems with many threads.