Lonworks Device Controls Technology Platform

LonWorks is a control network technology platform that was developed by Echelon Corporation. It is an open, non-proprietary technology that any vendor may incorporate into their products. LonTalk, the communications protocol used in LonWorks networks, has been adopted as a standard by ANSI (ANSI 709.1). The entire protocol is embedded into a computer chip called the neuron chip. It's easy for vendors to develop compatible products because all products that use the neuron chip are using the exact same implementation of the LonTalk protocol.

LonWorks devices are intelligent. The neuron chip provides computing power of an Apple II computer. Because the devices are intelligent, LonWorks control networks do not need computers or master control panels to operate, and the devices communicate with each other peer-to-peer without any master communications panels or gateways. Thus LonWorks control networks have a flat, non-hierarchical architecture and no single point of failure.

The greatest change from traditional control networks is this: LonWorks based control networks integrate all of a building's subsystems such as HVAC, Lighting, Card Access, and Power Monitoring on a single control network. This yields substantial savings in installation costs because only one network cabling and conduit system needs to be installed. It also means that one contractor is responsible for the design, installation and commissioning of the network that includes all of those subsystems. This is a major paradigm shift from the traditional design & installation process where the HVAC control system is the responsibility of the mechanical contractor and the lighting, card access, security etc. systems are the responsibility of the electrical contractor.

It is an open technology that had been incorporated into devices by many of the major construction industry vendors, including Belimo, Fugi Electric, General Electric, Honeywell, Hubbell, Johnson Controls, Philips Lighting, Siemens Building Technologies, Square D, Trane, the Wattstopper, and many others. Cisco Systems collaborated with Echelon to develop a standard architecture to connect LonWorks networks to the Internet.

It is an international standard that has been utilized in major construction projects in the United States, Europe, and Asia, including the 54,000-seat Pusan Asiad Main Stadium, located in Pusan, Korea; Enel's 47 million home remote electric meter reading project; and the new eastern region headquarters for the Federal Aviation Administration, located adjacent to Kennedy Airport in Queens, New York.
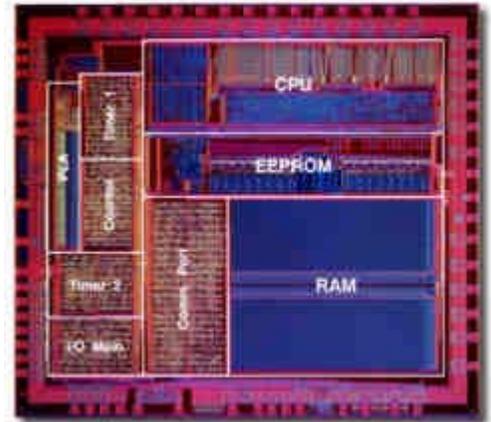
NEURON CHIPS

In order to achieve economical and standardized deployment, Echelon designed the Neuron Chip. The Neuron name was chosen to point out the similarities between proper network control implementation and the human brain. There is no central point of control in the brain. Millions of neurons are networked together, each providing information to others through numerous paths. Each neuron is typically dedicated to a particular function, but loss of any one does not necessarily affect the overall performance of the network.

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To the developer and the integrator, the beauty of the Neuron Chip lies in its completeness. The built-in communication protocol and processors removes the need for any development or programming in these areas. To refer back to the ISO/OSI reference model of a communication protocol, the Neuron Chip provides the first 6 layers. Only the application layer programming and configuration needs to be provided. This standardizes implementation and makes development and configuration relatively easy.

Most LonWorks devices take advantage of the functions of the Neuron Chip and use it as the control processor. The Neuron Chip is a semiconductor device specifically designed for providing intelligence and networking capabilities to low-cost control devices. The Neuron Chip includes three processors that provide both communication and application processing capabilities. The device manufacturer provides application code to run on the Neuron Chip and I/O devices to be connected to the Neuron Chip. Echelon Corporation designed the original Neuron Chip, and successor members of the family now designed and manufactured by Echelon's manufacturing partners. Cypress Semiconductor and Toshiba are all current producers of Neuron Chips. Multiple suppliers create a competitive environment for the Neuron Chips, provide reliable sources for the chips, and help drive prices down.

Neuron Chip

The Neuron Chip is a system-on-a-chip with multiple processors, read-write and read-only memory (RAM and ROM), and communication and I/O subsystems. The read-only memory contains an operating system, the LonWorks protocol, and an I/O function library. The chip has non-volatile memory for configuration data and for the application program, both of which are downloaded over the LonWorks network. At the time of manufacture, each Neuron Chip is given a permanent unique-in-all-the-world 48-bit code, called the Neuron ID. A large family of Neuron Chips is available with differing speeds, memory type and capacity, and interfaces. Approximately 24 million Neuron Chips had been shipped as of mid 2002.

A complete operating system including an implementation of the LonWorks protocol, called Neuron Chip Firmware, is contained in ROM on, or attached to, every Neuron Chip. Most LonWorks devices include a Neuron Chip, which has an identical, embedded implementation of the LonWorks protocol. This approach eliminates the "99% compatibility" problem and assures that connecting LonWorks devices together on the same network requires little or no additional hardware. The Neuron Chip is actually three, 8-bit inline processors in one. Two execute the LonWorks protocol; the third is for the device's application. The chip is, therefore, both a network communications processor and an application processor, significantly reducing the implementation cost for most LonWorks devices.