LONWORKS
Introduction
LonWorks networks are designed to transform everyday devices...
...into intelligent, interoperable, networked devices that communicate on a peer-to-peer basis using open standards...
... accessible from anywhere in the world
Chances are you’ve already experienced the power of LonWorks at home, work or play without realizing it.

• Seen a Broadway play? LonWorks lighting systems light many Broadway stages
• Been to Las Vegas lately? LonWorks devices control the fountain show each night at the Bellagio Hotel
• Got Milk? LONWORKs devices run the largest milk distribution facility in Greece
• Ridden the New York City Subway? The New York City transit Authority has adopted LonWorks as the standard to control device throughout its subway cars
• Received a parking ticket in Amsterdam? LonWorks technology keeps Amsterdam's parking meters working
LonWorks Applied

Where does LonWorks get used and by whom:

• Automotive manufacture - parts pull, testing paint spaying
• Electro-pneumatic braking on trains
• Food Processing
• IC manufacture - gas distribution and tools
• Material handling
• Paint booths
• PCB Manufacture
• Printing
• Pulp and Paper mills
• Textiles - dyeing
• Water and Waste water treatment
• Building Automation Control systems
• Home Automation
A LON Story

- Local Operating Network
- Echelon founded in 1988 by AC ‘Mike’ Markkula
  ◦ CEO of Apple Computer
- First Neuron chip created in 1991
- Echelon is global
  ◦ 200+ employees
  ◦ Nasdaq listed ELON
  ◦ 100+ products
- LonTalk is an open protocol
  ◦ ANSI/EIA
Echelon is focused on four primary markets

- Building Automation
- Home/Utility Automation
- Industrial Automation
- Transportation Automation
Echelon makes tools for building end-to-end solutions...

Network Management Software

Development Tools

Power Line & Twisted Pair Transceivers, Controllers, NICs

Routers, Internet Servers
...and for connecting everyday devices to (and over) the Internet

- The i.LON™ Internet Server family enables millions of existing LONWORKS products to be accessed via the Internet
LonWORKS Network Design

LonWORKS Technology Review
Kinds of Control Algorithms

- **Master/Slave**
  - A single controller making all the control decisions
  - Single point of failure
  - Difficult to expand
  - Costly to install – more wiring needed to connect sensors and actuators
  - Proprietary programming
  - Proprietary solutions
Kinds of Control Algorithms

- Peer-to-Peer
  - Distributed control intelligence
  - No single point of failure
  - Easy to expand and add more devices
  - Less costly wiring installation
    - *No home I/O wiring runs*
Open and Independent

- Robust, reliable, proven device networking protocol on a chip
- Manufacturers of smart devices can get to market quickly
- End users no longer locked into single supplier
- Integrators can choose best of breed devices
- LonTalk is media independent
- LonWorks tools operate on multiple platforms
- Multi-industry standards group ensure interoperability
Look for the LONMARK Label

300+ members from 17+ countries ensuring plug-and-play operation

- Non-profit industry association
  - Includes manufactures, integrators, application developers, and end-users
- Establishes technical guidelines
  - Industry specific task groups
- Promotes the LONMARK standard and certifies product conformance
- Provides a resource of device information
- Governed by board of directors made up of industry members
  - Includes sponsor members and elected representatives
  - All members have a vote
Networking Technology

- Allows integration of device information across network of any size including the internet
- Requires the assignment of a logical identity for each device called the Domain/subnet/node address
  - Assigned by the network management tool
- Allows message packets to be isolated or forwarded by intelligent LonWorks routers
LONWORKS Network Elements

- **Channel**
  - Media to which devices are connected
- **Device**
  - Actuator, sensor, controller, or combination
  - LonMark Certified
- **Network Tool**
  - Installation tool
  - Human machine interface (HMI)
LonTalk Protocol

- Globally recognized standard ANSI/EIA 709.1
- Designed for control applications – not data applications
- Includes all 7 layers of the ISO standard model for network communication
- Implemented on the neuron chip or equal processor
- Is media independent
- Is an open and published standard available to anyone

7 Application
6 Presentation
5 Session
4 Transport
3 Network
2 Data Link
1 Physical

Physical Media

Physical Media:
- Neuron C Program
- Network Variables
- Network Management
- Message Service
- Addressing & Routing
- Media Access
- Physical Connection
Network Variables

- The dynamic data sent or received by network devices
- Signal-type independent – temperature, pressure, volume, flow, etc.
- SNVT’s are standard network variable types as defined by the LonMark organization
  ◊ Known and documented structure, size, range, etc.
- UNVT’s are manufacturer defined
  ◊ Tools may require resource files to document data format
Configuration Properties

- Define device behavior such as setpoint, high limits, throttle, etc.
- SCPT's are standard configuration property types as defined by the LonMark association
  - Known and documented structure, format, range, etc.
- UCPT's are manufacturer defined
  - Tools may require resource files to present values in a meaningful way.
LonWorks Architectures
Simple Device Network

- Devices communicate with each other directly
- No network tool required after commissioning the devices
- Tool is required to perform network maintenance such as adds/moves/changes or device replacement
Local Client Applications

- LNS database resides on same PC as the network tool
- LNS communicates to devices via network interface hardware and/or software
  ◊ Twisted Pair, Powerline, IP
Remote Client Applications

• Remote client is an application that runs other than on an LNS Server PC
  ◊ LNS Database is accessed over the network media or over IP
• It can be attached to any LONWORKS channel, including a LONWORKS/IP channel
• Requires the LNS Server application running at the PC where the LNS database resides
  ◊ The LNS Server application supports up to 100 clients and 255 LNS databases opened simultaneously
Web Based Monitoring and Control Clients

- Any PC that can support a standard web browser interface
  ◊ Internet Explorer, Netscape, Etc.
- Network data served up as HTML web pages from LonWorks webserver device
  ◊ ILON100, iLon1000, Plexus, etc...
- Can perform monitoring and control of network variables but cannot perform network management functions

Netscape or Internet Explorer running at remote client
• Internet to LonWorks routers (i.LONs) can be used to create one network by connecting remote locations over LONWORKS/IP channels
• LNS Server is not required for day-to-day operation
• up to 40 i.LON routers per LONWORKS/IP channel
• Time server may be required to synchronize message delivery across wide area networks
LonWorks Topologies
Bus Topology

- A physical routing of the communication channel that includes a distinct beginning and end
- Must be doubly terminated at beginning and end
- Device to device wiring or short stubs
- Easiest to troubleshoot
- Difficult to expand when you need to add more devices
Free Topologies

- A flexible wiring structure of the communication channel that includes a ring, star, loop, or combination
- Can have long stubs to devices and tools, tap in anywhere on the channel
- Difficult to troubleshoot
- Easy to expand
- Easy to exceed media limits
- Requires one terminator installed anywhere on the channel segment
Backbone Topology

- Connects routers to a common backbone channel
- Typically installed in a bus topology and includes mostly routers, network tools, and systemwide control devices
- Can be high speed twisted pair – XF1250
- Can be high speed IP channel
- Reserves bandwidth for network tools
Time for your Questions