Using IP as a Backbone for ANSI 709.1 Networks

A New Twist on LonWorks Network Topologies (And It Saves Money, Too!

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Document Version 1.0 2002.03.06

Overview

The advent of routing ANSI 709.1 (LonTalk©) over IP (Internet Protocol) has created new opportunities to extend the reach of LonWorks© networks and offers new topology options for LonWorks System Integrators (LSIs) in designing, installing and retrofitting control networks.

In a typical LonWorks installation, a TP/XF-1250 (TP-1250) channel is used as a backbone of the control network, with multiple TP/FT-10 (FT-10) channels stubbed into the backbone via TP1250/FT10 routers. Adept Systems has now released the GadgetGateway©, the first of a new breed of low-cost LonTalk/IP routers, which for the first time, makes it both technically and economically desirable to use a LonTalk/IP channel as a backbone for LonWorks networks.

Introduction

When LSIs begin planning a LonWorks installation, one of the first decision points centers around network topology. In Echelon Product Training , three network topologies are described – Backbone Structure, Collapsed Backbone Design and Free Topology Layout (see Figure 2).

The most common network topology used by LSIs is the Backbone Structure. In the Backbone Structure, stubs of a suitable channel type connect the devices on the network, and these channels are connected to each other via a fast backbone channel. Typically, an FT-10 channel is used to connect the devices on a network and a TP-1250 channel is used for the backbone. A separate TP1250/FTT router is used to connect each FT-10 channel to the TP-1250 backbone as shown in Figure 3.

For many basic installations, the topology described in Figure 2 is adequate. But often, LSIs are finding that they have to work around many of the limitations of the TP-1250 channel.

This article will discuss the limitations of the TP1250 channel and how the use of a LonTalk/IP channel overcomes these limitations and creates new options and opportunities for LSIs.

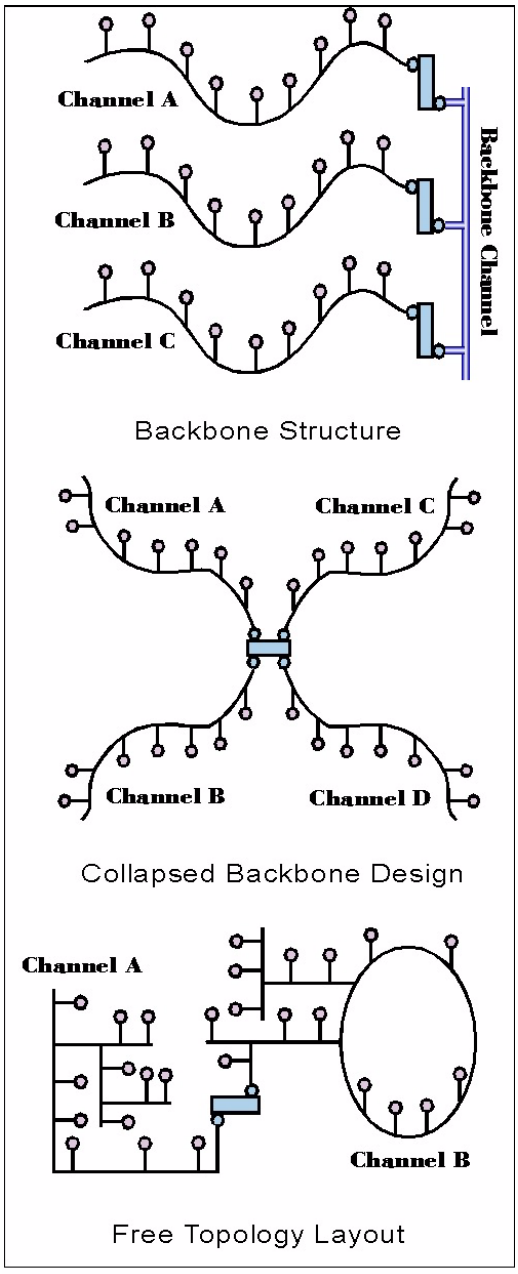

Figure 2:Three LonTalk Network Topologies

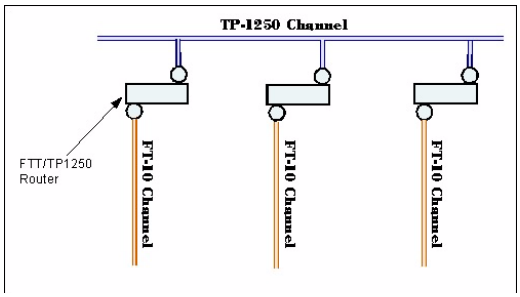

Figure 4: TP-1250 Backbone

TP-1250 Backbone Limitations

When using a TP-1250 channel in a LonWorks Backbone Structure topology, LSIs need to be keenly aware of the limitations of the channel in the design, installation and maintenance phases of the project. Total line length, bandwidth capacity and retrofitting implications need to be closely monitored.

Length/Wiring Limitations

The maximum total length on a TP-1250 channel is 130m, with a maximum stub length of .3m. LSIs must plan their wiring carefully to ensure that the TP1250/FTT routers on the network are physically as close as possible. This limitation is particularly troublesome if a project spans multiple buildings. While repeaters can be installed to extend the effective length of a TP-1250 channel, each new repeater requires additional planning, wiring, maintenance and supporting infrastructure (power, enclosure panels, etc.).

Bandwidth Limitations

When LonWorks was initially introduced, the 800 packets per second throughput of a TP-1250 channel seemed adequate for any foreseeable project. In the mean time, control systems have become larger and more complicated. Network management tools and monitoring, scheduling and alarming applications are taking a bigger and bigger slice of the network capacity.

It only takes six FT-10 channels running at full capacity to max out a TP-1250 channel . The result is that without careful planning, even moderate-sized LonWorks installations will often exceed the TP-1250 channel capacity. System Integrators have been forced to partition control networks based on infrastructure limitations. The result is a longer (and more expensive) planning cycle, and a final design that is more difficult to manage and maintain than it should be.

Retrofitting existing buildings

The flexibility of the FT-10 channel characteristics makes it an ideal solution for retrofitting control networks into existing building. Support for both bus and free topology, long maximum cable length specification , and ability to stub into the channel at any point, makes the installation process straight forward. However, the installation of a TP-1250 backbone into an existing building can present significant challenges to LSIs. Careful planning is required to ensure that repeaters and routers are installed in locations that meet the length and bandwidth specifications. New wiring must be laid to facilitate the backbone. For multi-building installations, the cost on new wiring quickly makes retrofit proposals cost prohibitive. If the required locations for repeaters does not correspond well to the building layout, allowances must also be made for new power and control panel installations.

LonTalk/IP as a LonWorks Backbone Channel

IP has excellent characteristics for use as a control network backbone. It's fast, it can reach anywhere, and IP infrastructure components are cheap. By tunneling ANSI 709.1 on top of an IP infrastructure, the benefits of IP are realized without having to sacrifice the functionality and robustness of LonTalk. (See Figure 4:)

Overcoming distance as a limitation in network backbone design

What is the maximum distance of a LonTalk/IP channel? Only as far as the Internet reaches. While latency issues must be carefully considered when designing a control network that spans an IP network, distance and it's associated wiring costs no longer need to be the limiting factor. This capability alone creates new market opportunities for LSIs. Management, monitoring and alarming applications can now be centralized for multi-site organizations. New value propositions for lowering management

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costs and improving consistency and efficiency in control networks can be presented to customers.

Dramatic improvement in backbone capacity

With an estimated throughput of over 50,000 packets per second , a dedicated 100 Mbit LonTalk/IP channel increases the LonTalk backbone capacity by at least sixty times . With this increased bandwidth capacity, System Integrators can design systems that are less complicated and easier to manage, without impacting the stability or capabilities of the system.

Significant cost savings on retrofits

Most commercial buildings have already gone through the process of creating an Ethernet infrastructure. A LonTalk/IP channel can leverage this infrastructure and completely eliminate the cost of rewiring for a TP-1250 backbone. This becomes especially significant in multi-building installations. By removing this cost barrier, System Integrators can realize new retrofit opportunities that were not feasible before.

The GadgetGateway as a Core Infrastructure Component in LonTalk/IP Backbone Topologies

LonTalk/IP routing technology has been available for several years. While now commonly used to facilitate multi-building installations, the market has not yet widely adopted the LonTalk/IP channel as a replacement for a TP-1250 backbone. The singular barrier to this market shift has been cost. An FTT/1250 router costs about US$400, and LonTalk/IP routers started at about US$1300. So, moving to an IP backbone would typically add thousands of dollars to the raw infrastructure costs for a LonWorks installation. Without hard data that justified this increased cost, System Integrators have tended to bite the bullet and design LonWorks infrastructures around the limitations of the TP-1250 backbone.

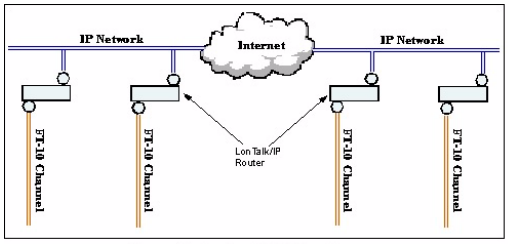

Figure 4: IP Backbone with LonTalk to IP Routers

The release of the GadgetGateway now dramatically changes the LonWorks backbone landscape. Priced at under US$600 in moderate volume , the raw infrastructure costs are similar, if not lower than when using a TP-1250 backbone. Lower wiring expenses alone generally more than compensate for the marginal price difference of the routers. Further, the GadgetGateway is the only standards-based

Figure 1: GadgetGateway I 709.1 (LonTalk™) to IP Router

LonTalk/IP router that supports 100BaseT in addition to 10BaseT. Thus, GadgetGateway backbones can support up to 10 times the bandwidth as other LonTalk/IP routers. LSIs that adopt the GadgetGateway as a standard component for LonWorks backbones will no longer have to spend time and effort designing around the limitations of the TP-1250, and can dedicate more time and effort to adding value for their customers.

Configuration of the GadgetGateway

If the need for the LonTalk/IP router is just to connect two LonWorks networks over an Ethernet link, two GadgetGateways can be configured to act as a single point to point ANSI 709.1 router. In this scenario, ANSI 709.1 management tools, such as LonMaker, treat the two

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GadgetGateways as a single ANSI 709.1 router, where each end is con-nected over an Ethernet link. Using either the serial port or the web interface, the two GadgetGate-ways are first configured to talk to each other over Ethernet. Second, using a standard network man-agement tool on either 709.1 channel, the side A and side B of the "router" formed by the two gate-ways is then configured. Future versions will allow configuration of the router forwarding tables from the IP side.

In more complex installations, the GadgetGateway can be configured as a point to multi-point router. In this scenario, the GadgetGateway is con-figured to broadcast to or receive from multiple other gateways. This allows for more effective and efficient networks by reducing the number of routers needed to interconnect the 709.1 channels. When used in implementing a LonTalk/IP backbone topology, each GadgetGateway is configured to broadcast and receive from each GadgetGateway on the backbone.

Interoperability

The recently EIA approved LonTalk/IP Tunneling Specification (EIA 852) allows for multi-vendor installations of LonTalk/IP routers and gateways. The GadgetGateway is specifically designed and tested in order to be interoperable with the i.Lon 1000 and the Coactive-LL Router. This is particularly useful when extending existing systems that are already using EIA 852 compliant LonTalk/IP routers and gateways. GadgetGateway allows you to use the configuration tools from either i.Lon or the Coactive-LL, so LSIs that are already using either of these components will have an easy learning curve in order to integrate the GadgetGateway into their solutions.

Conclusion

The advent of low cost, standards based LonTalk/IP routers has created the environment for a major shift in how LonWorks System Integrators design and install control network topologies. LonTalk/IP backbones allow for control networks that are easier to design, manage and maintain than traditional backbone installations. The use of a low-cost solution, such as the GadgetGateway, also means less expensive infrastructure costs, and removes the last barrier to widespread adoption of LonWorks/IP as a backbone channel. While the priority and guaranteed packet delivery characteristics of the TP-1250 channel will continue to be important for some installations, the limitations of wiring costs, limited bandwidth, and incremental design, management and maintenance expense will soon relegate the TP1250 to a seldom-used channel type. In addition, by leveraging the strengths of IP and maintaining the core values of LonWorks networks, the new breed of LonTalk/IP routers and gateways further entrenches ANSI 709.1 as a leading technology in control networks.

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