Tech Note

PPP over Ethernet (PPPoE)

This technical note provides background information on the PPPoE protocol and ARC International's plans for a product.

Background

Low cost broadband technologies such as DSL (Digital Subscriber Line) have greatly increased the number of computer hosts that are permanently connected to the Internet. Computers connected to the Internet via DSL do so through an Ethernet link or an ATM link, from the PC to the DSL modem. When using Ethernet, which is the easiest and cheapest way to link the PC with the DSL modem, plain TCP/IP could be used with no additional protocols. However, TCP/IP by itself provides no form of security or authentication. The Internet service providers require at least some kind of user authentication. In the past they have used the authentication services of PPP (Point-to-Point Protocol), which provides secure login, and traffic metering, among other advanced features. PPP was widely adopted by Internet service providers when they typically only provided dial-up modem access to their customers.

PPPoE (PPP over Ethernet) was designed to bring the security and metering benefits of PPP to Ethernet connections such as DSL. PPPoE is used to allow Internet service providers (ISPs) to use their existing authentication systems from their dial-up service over a broadband-based connection. It also allows for ISPs to resell the same line multiple times.

Because of the ever increasing demand for bandwidth to the home PPPoE is being adopted as a technology for DSL and cable modems. It is not the most elegant solution but it makes good use of existing infrastructure and is relatively simple to install in the home. The demand for PPPoE will follow the demand for DSL.

What is PPP?

PPP stands for Point-to-Point Protocol. It is often used to transport TCP/IP data and is included in Precise/RTCS™. PPP is an extension to TCP/IP that adds two additional sets of functionality:

- it can transmit TCP/IP packets over a serial link
- it has login security and authentication

TCP/IP by itself cannot be transmitted over a serial link. Currently it is not feasible to extend an Ethernet network over many thousands of miles. Telecommunications companies however offer serial communications links around the globe right now and have done so for many years. To make TCP/IP work over these serial links, it was necessary to create a protocol that could transmit TCP/IP packets over serial lines. The two protocols that do this are:

- SLIP (Serial Line Internet Protocol)
- PPP

PPP is more feature rich and has largely supplanted SLIP.

When serial links that are part of the public telephone system are used, care must be taken to ensure the authenticity of all communications. To this end PPP incorporates user name and password security. The two main protocols that do this PPP authentication are PAP and CHAP (Precise/RTCS supports them both). Because of its ability to route TCP/IP packets over serial links and its authentication capabilities, PPP is generally used by Internet Service Providers (ISPs) to allow dial-up users to connect to the Internet.

The significance of PPP over Ethernet has to do with its far greater ease of use versus competing approaches. By making high-speed access easier to use for end consumers, and more seamless to integrate into the existing infrastructure for carriers and ISPs, PPPoE has facilitated the widespread adoption of High-speed access services.

Also, PPP over Ethernet provides a major advantage for service providers by maximizing integration with and minimizing disruption of service providers' existing dial network infrastructures. Through tight integration with existing back office automation tools that ISPs have developed for dial customers, PPPoE enables rapid service deployment and cost savings. From authentication, accounting and secure access to configuration management, PPPoE supports a broad range of existing applications and services.

What is PPPoE?

PPPoE is PPP (which was originally designed for serial communications) adapted to run over Ethernet. The protocol is defined in RFC 2516. Since PPP was designed to do things that were either impossible or unnecessary with Ethernet, one might wonder why one would want to use PPP over Ethernet at all. The main reason for the use of PPPoE is allow Internet Service Providers to easily upgrade their legacy infrastructure to support new higher bandwidth solution such as DSL.

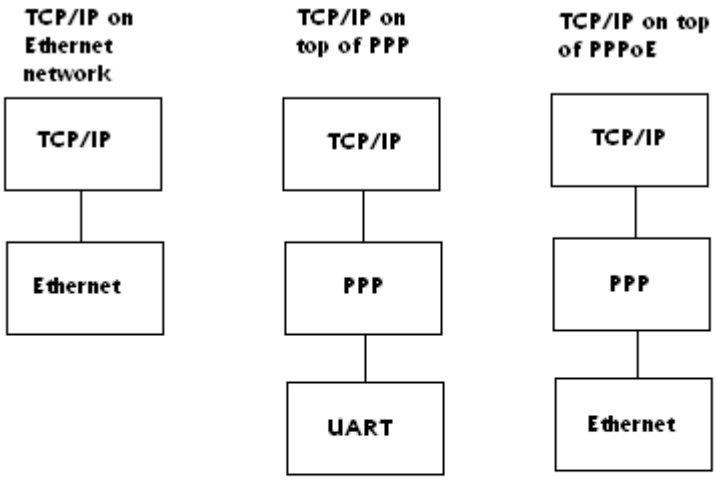
PPPoE implementation requires virtually no more knowledge on the part of the end user other than that required for standard Dialup Internet access. In addition, PPPoE requires no major changes in the operational model for Internet Service Providers (ISPs) and carriers

If we were to compare TCP/IP traffic to vehicle traffic, the basic TCP/IP protocol would be comparable to a network of city streets. Streets can serve many access points. It is easy to get on to and off of the street. Additional access points can be added with little disruption. It is hard to tell how many cars and people are actually using each street. PPP, on the other hand, would be comparable to a railway. Travel is generally between two well-defined points. You can't get on and off anywhere. It is relatively easy to count and monitor passengers. You need a ticket to board.

If this is true, then isn't PPPoE like running railway tracks down Main Street? In fact, yes, it is. That is what tramways do. Without disturbing main street traffic, they bring the advantages of railways. They offer speedy access between two well-defined points and allow you to count passengers. And you need a ticket to board.

Serial ISPs already use PPP over modem communications. DSL providers on the other hand use Ethernet, not serial communications. Because of this, many require the added functionality of PPP over Ethernet, which allows them to secure communications through the use of user logins and have the ability to measure the volume of traffic each user generates.

The following diagram illustrates the difference in the network task when using TCP/IP in three different situations: on top of Ethernet, on top of PPP, and on top of PPPoE.



One important thing to remember about PPPoE is that it creates a virtual point-to-point network on an Ethernet network (which is normally a broadcast network). What this means is that a PPPoE client can only communication with one other node in the network. In order to communicate with any other node the connection with the original node must first be broken. This is vastly different than TCP/IP running directly on top of Ethernet, which allows multiple communications with any node on the Ethernet network.

Who uses PPPoE?

Internet Service Providers that offer DSL and cable modem service are using PPPoE right now.

DSL providers that require the use of PPPoE generally supply their choice of PPPoE software to their subscribers for the PC or Workstation and the DSL or cable modem will have an embedded version of PPPoE in the firmware.

References

Check out these web sites for more information.

http://www.carricksolutions.com/pppoe.htm

http://www.techtv.com/help/story/0,23158,2443984,00.html

http://www.vicomsoft.com/knowledge/reference/PPPoE.html